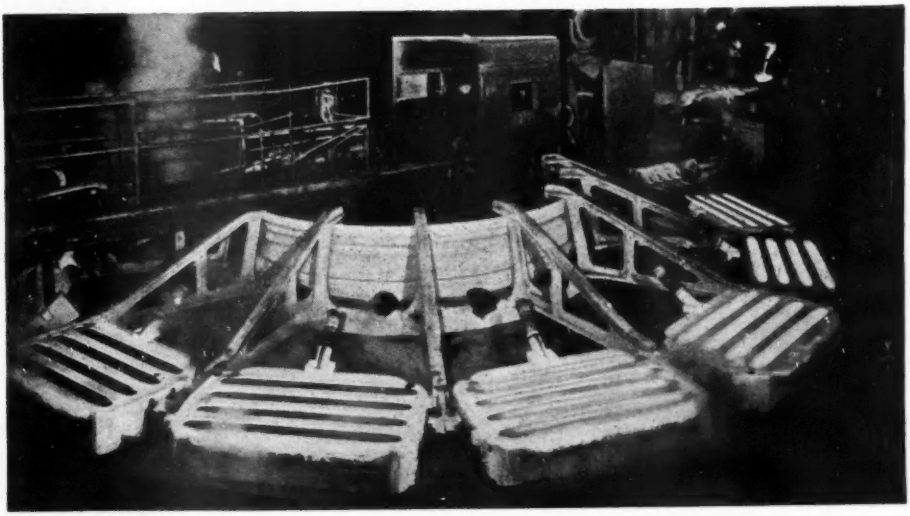
ELECTRICAL TIMES

THURSDAY
17 SEPT. 1953
NINEPENCE



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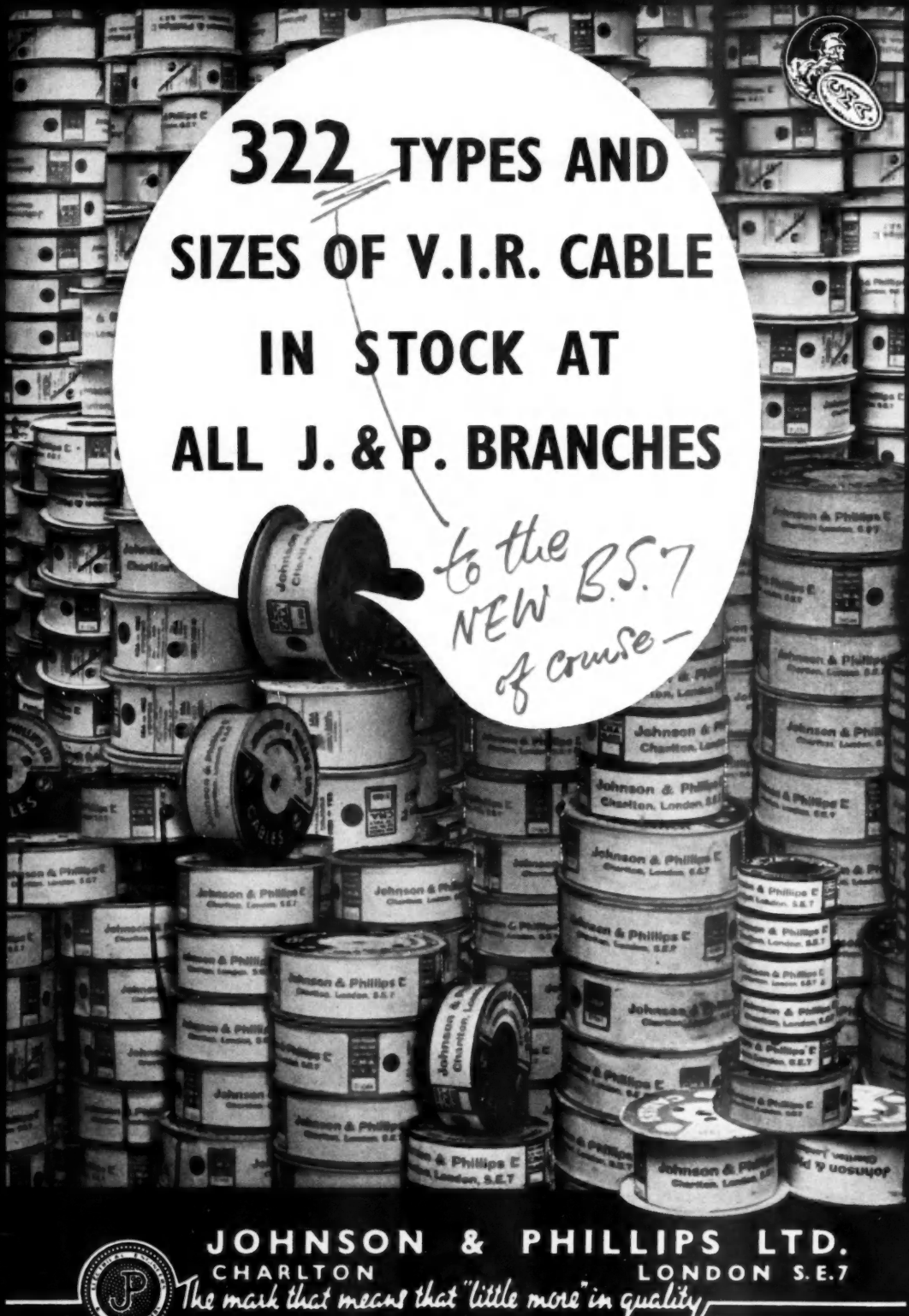
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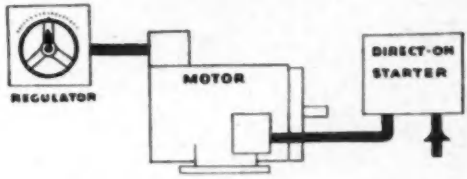

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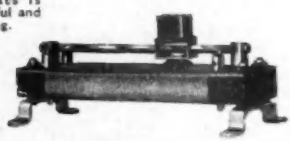

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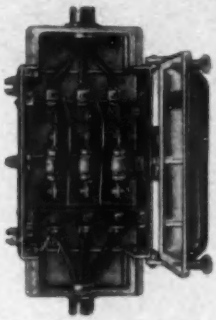

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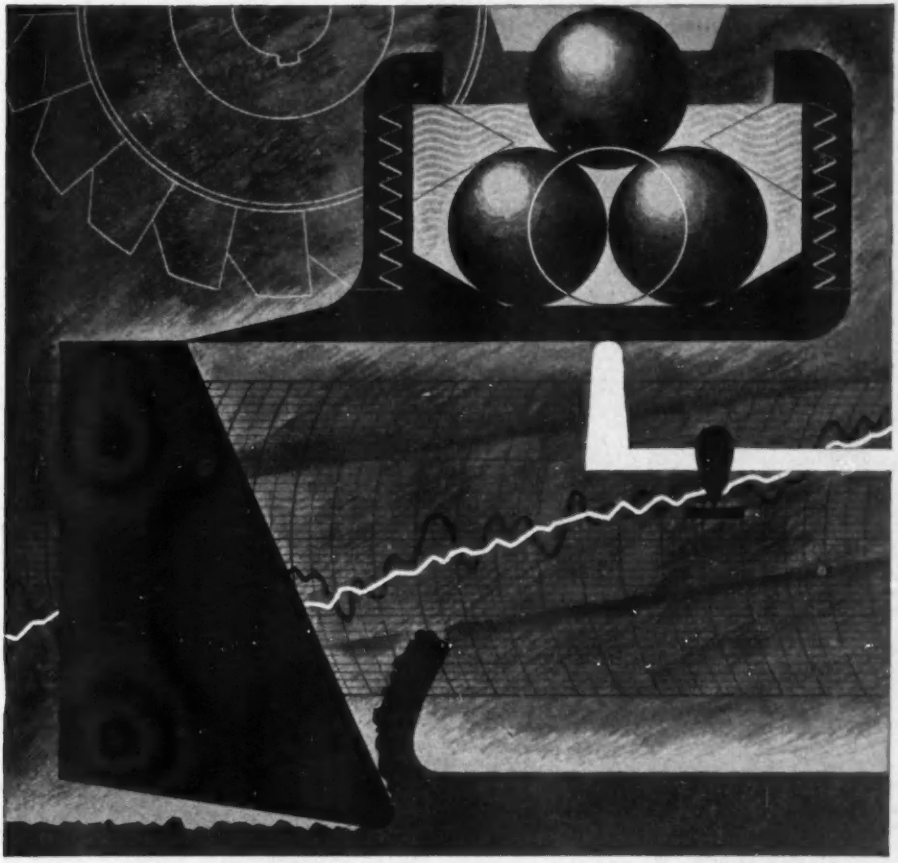

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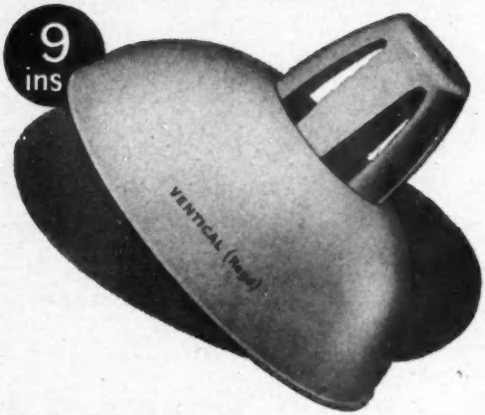

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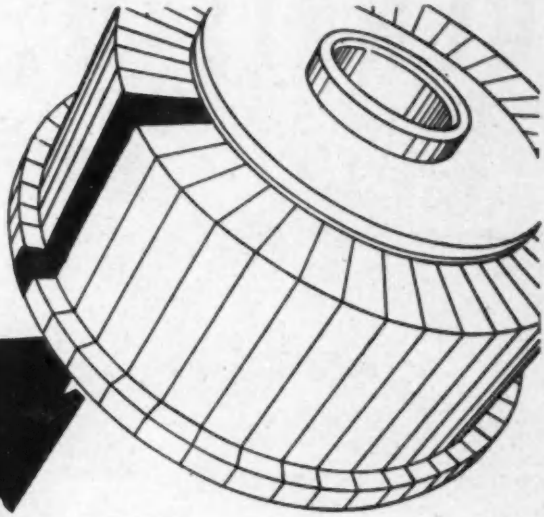

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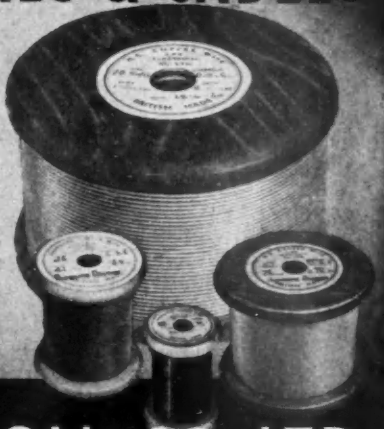

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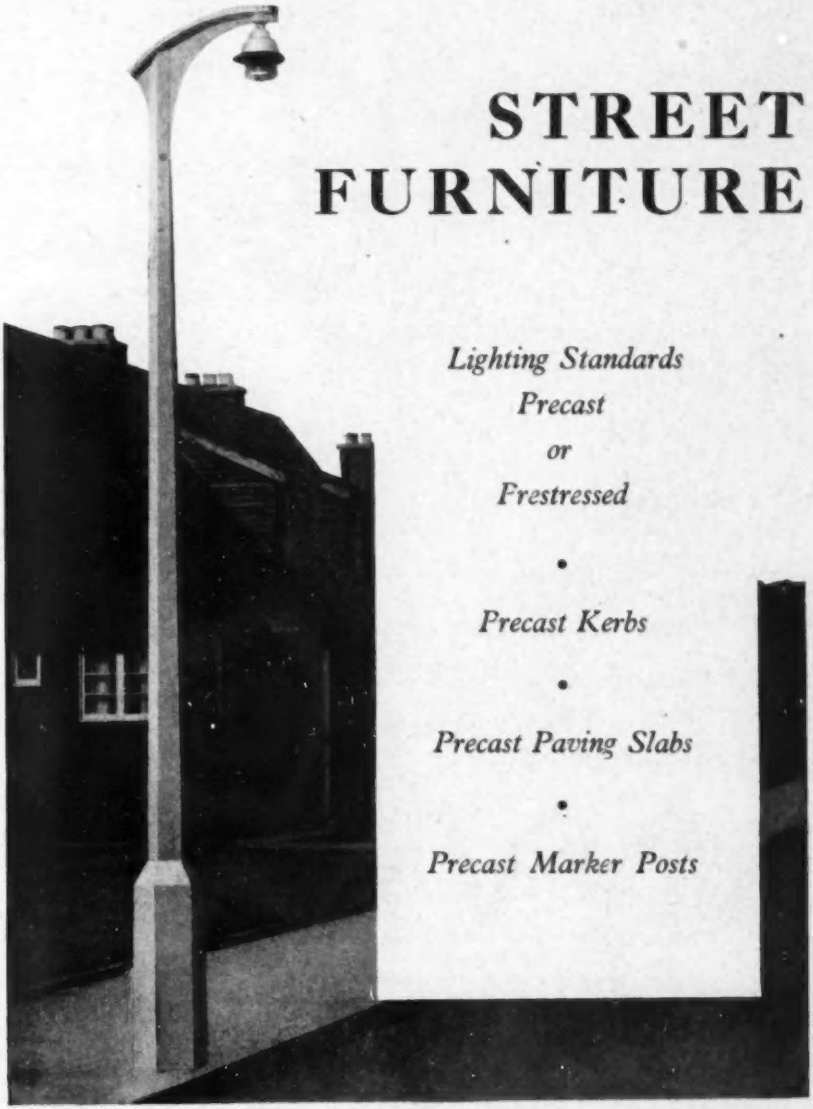

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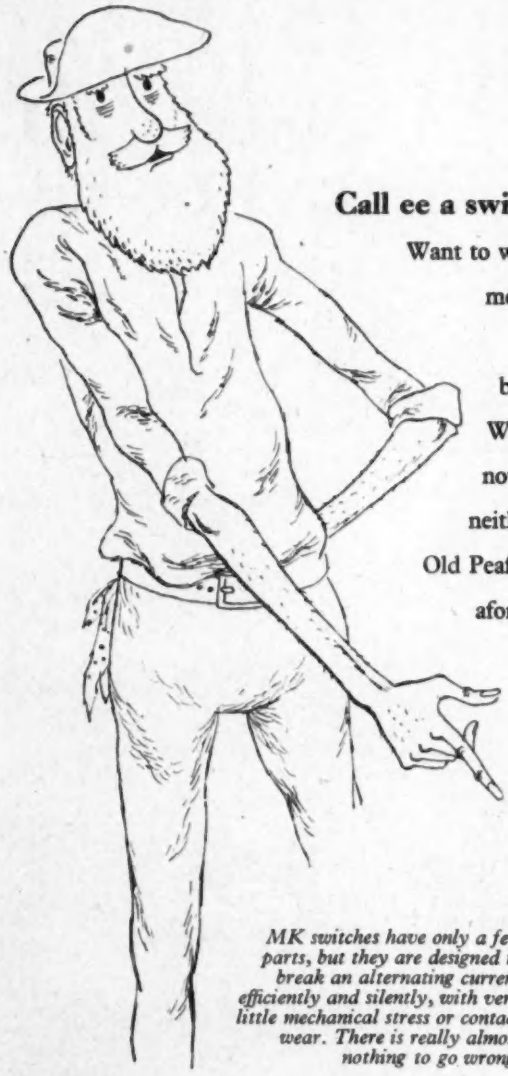

Call ee a switch, says Oi

Want to watch out about giving short measure, young feller. You be taking after frizzen-haired barmaid at Dog & Duckling. When I were a boy (aarr, and not so long gone as you think, neither) a switch were a switch. Old Peafaggot, im wot 'ad this shop afore you, used to say switches was like wenches—all the better for a bit of weight and a bit of noise.

MK switches have only a few parts, but they are designed to break an alternating current efficiently and silently, with very little mechanical stress or contact wear. There is really almost nothing to go wrong.

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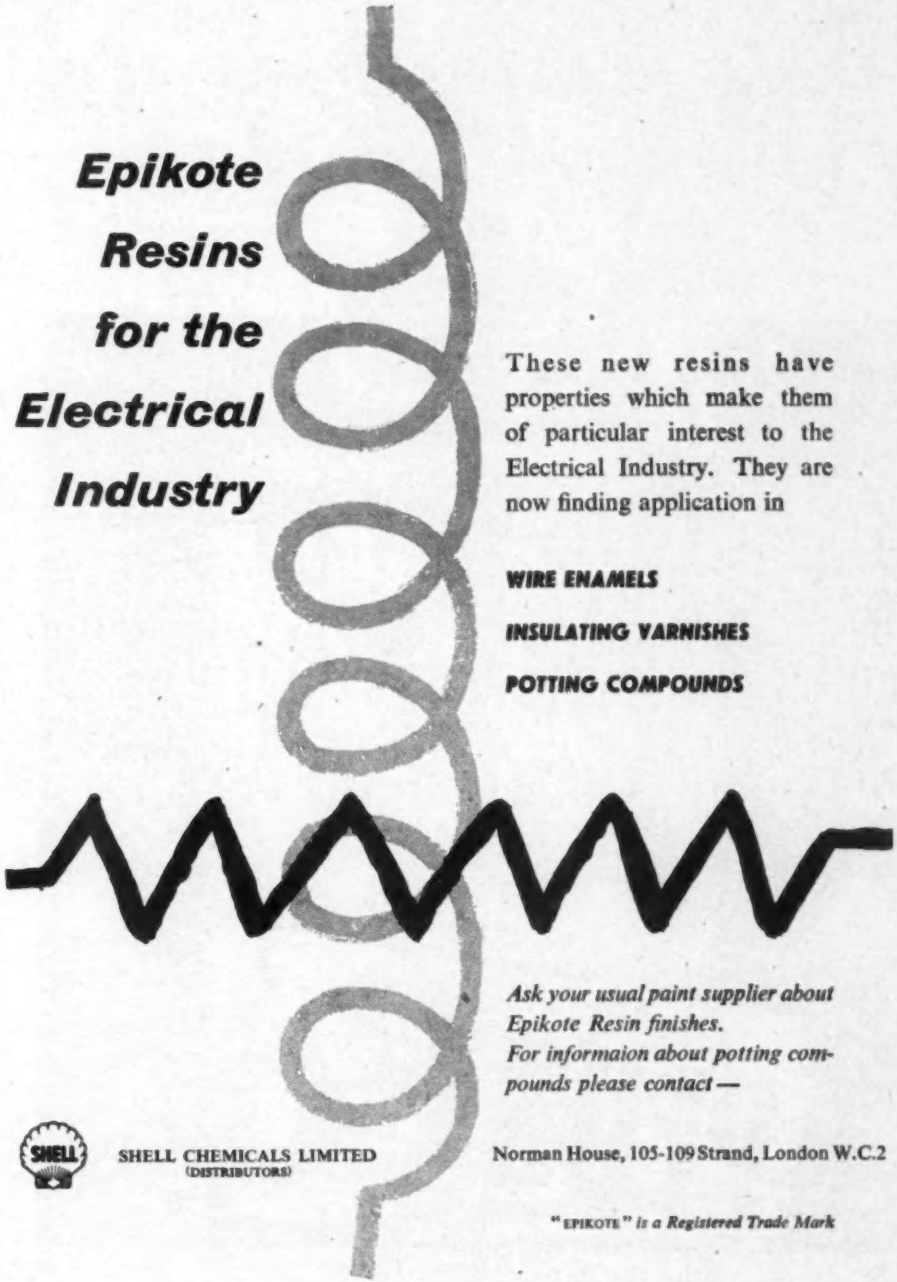

These new resins have properties which make them of particular interest to the Electrical Industry. They are now finding application in

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The ENGLISH ELECTRIC Company Limited

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which is now putting over

THE NEW PRICE OF

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which appears on page 71 of this issue

It's all a matter of research and good design translated into practice. The anisotropic alloy used in the magnets of our commercial grade meters has high coercivity and an almost flat recoil line, permitting large magnet gap and maximum freedom from external interference. That's good technique. However, you're concerned with results. Repeat orders from all over the world for our electricity meters prove that in practice they're all you want them to be and that

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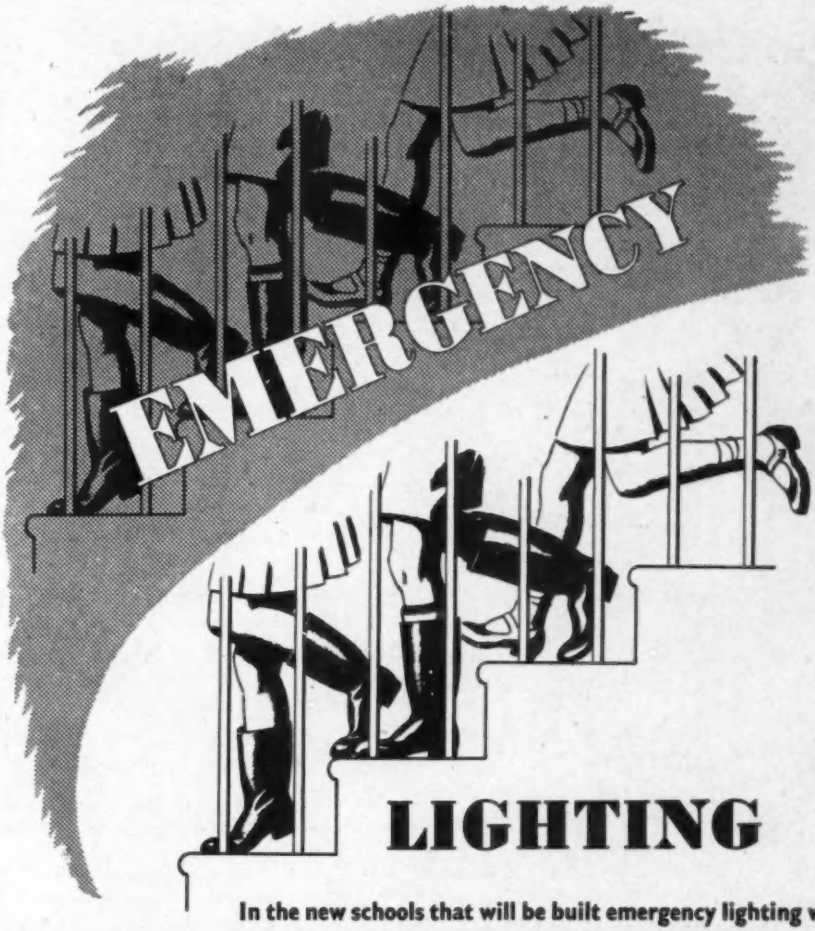

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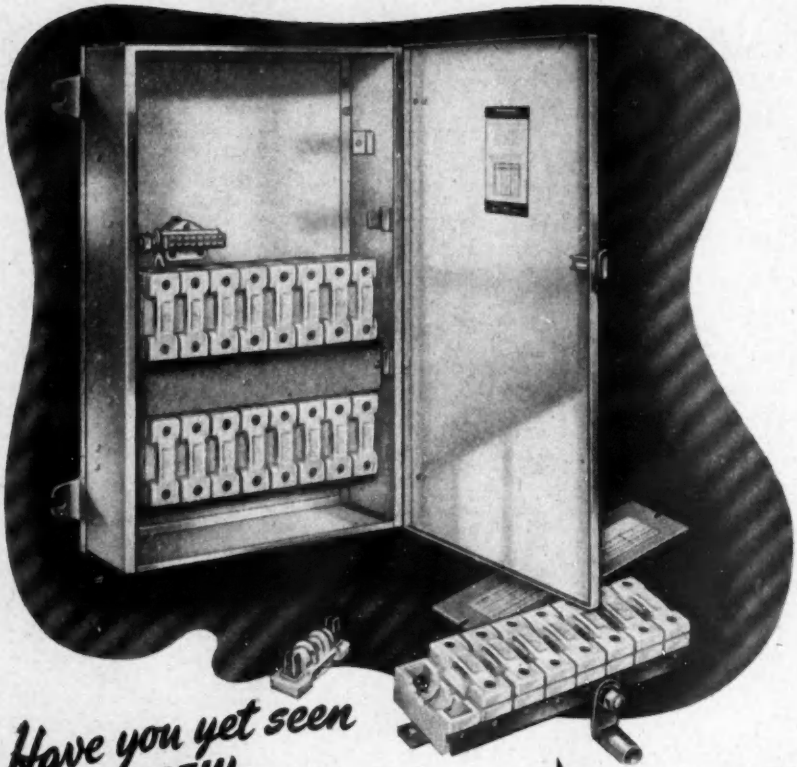

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- **Extreme Lightness without loss of rigidity or toughness.**
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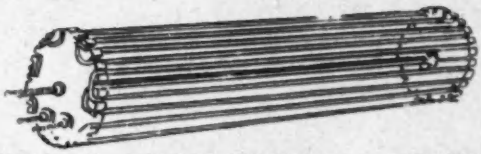

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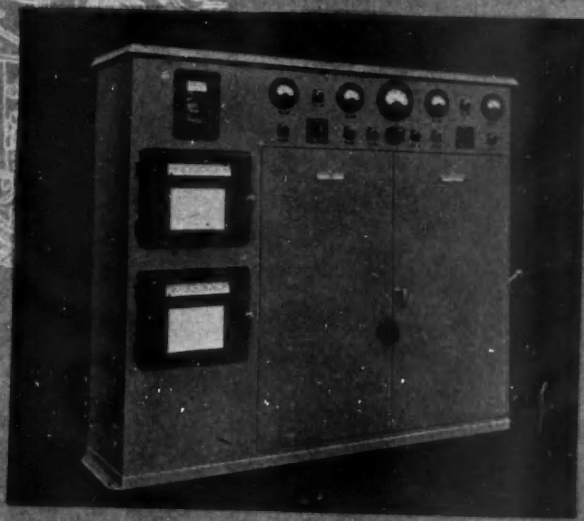

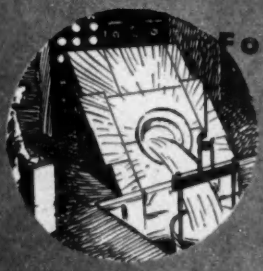

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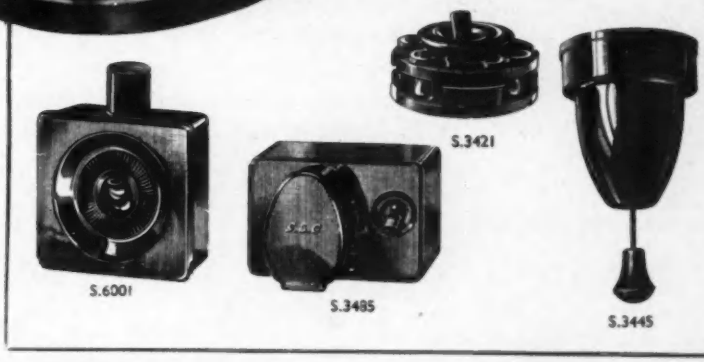

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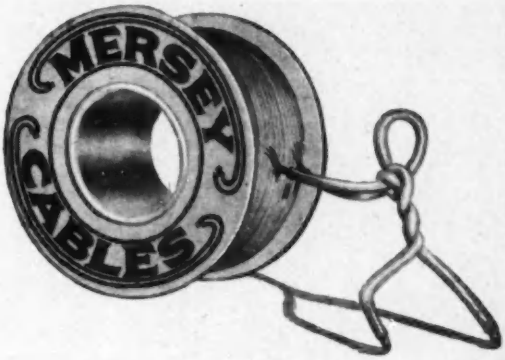

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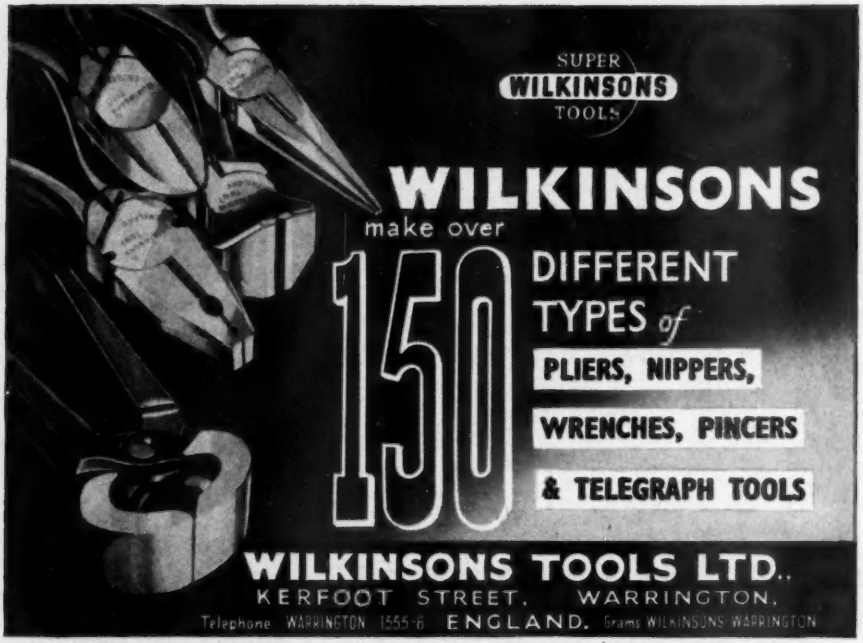

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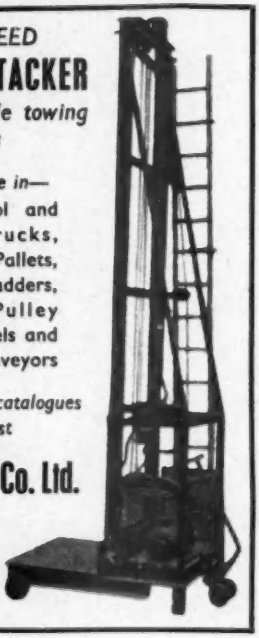

ANGEL TRUCK Co. Ltd.

Meteor Works,
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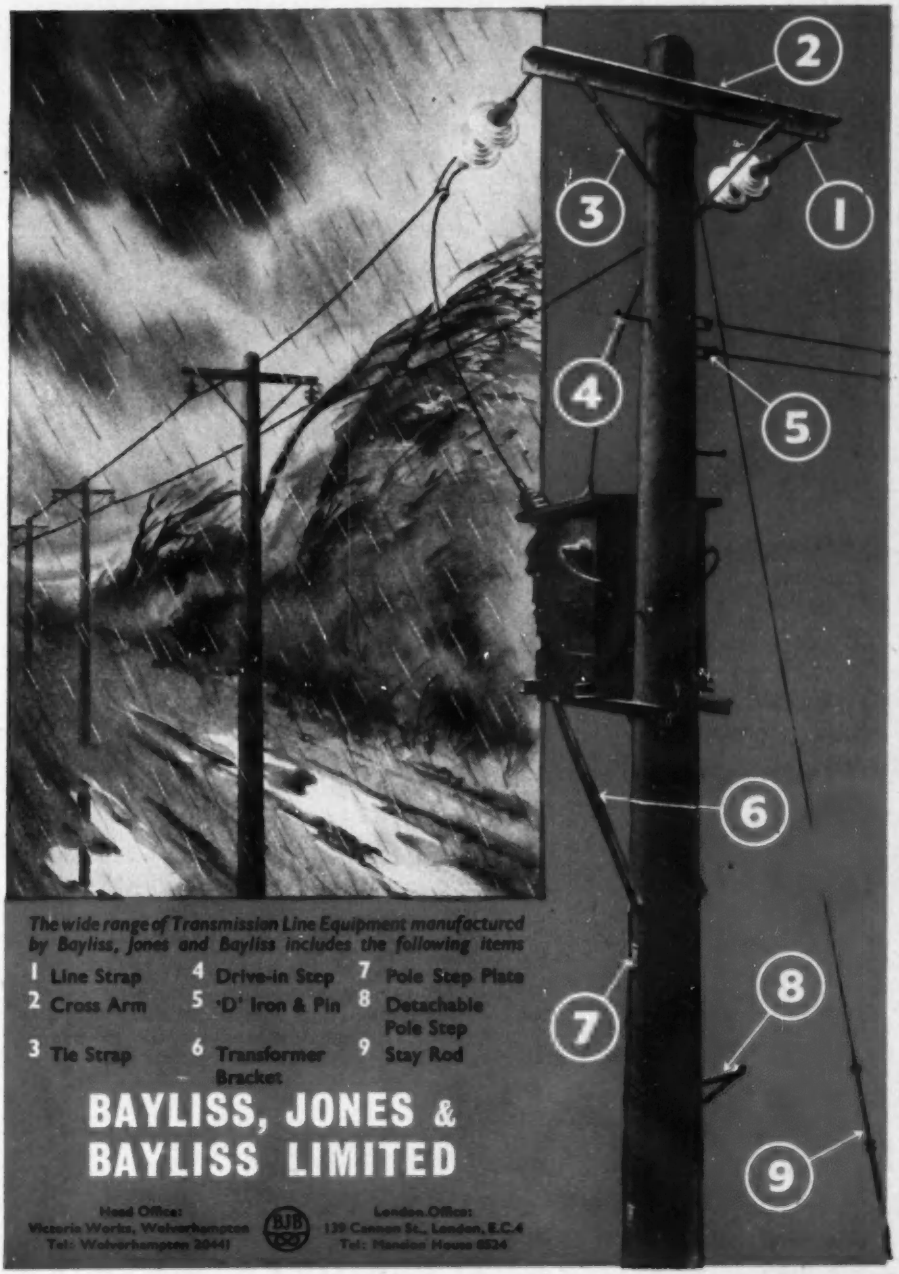

The wide range of Transmission Line Equipment manufactured by Bayliss, Jones and Bayliss includes the following items

1 Line Strap
2 Cross Arm
3 Tie Strap
4 Drive-in Step
5 'D' Iron & Pin
6 Transformer Bracket
7 Pole Step Plate
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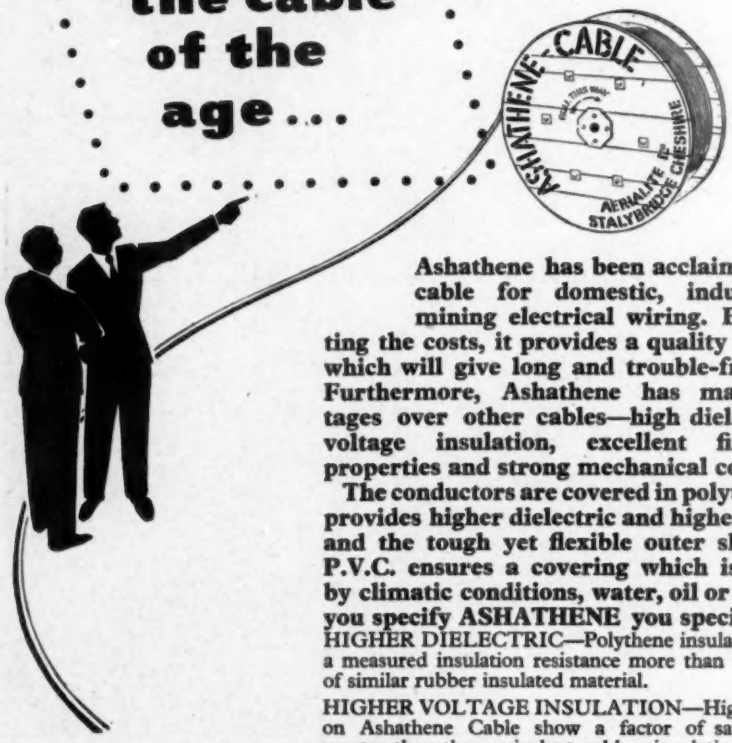
This is the cable of the age...



Ashathene has been acclaimed as THE cable for domestic, industrial and mining electrical wiring. Besides cutting the costs, it provides a quality installation which will give long and trouble-free service. Furthermore, Ashathene has many advantages over other cables—high dielectric, high voltage insulation, excellent fire-resisting properties and strong mechanical construction.

The conductors are covered in polythene which provides higher dielectric and higher insulation and the tough yet flexible outer sheathing in P.V.C. ensures a covering which is unaffected by climatic conditions, water, oil or acid. When you specify ASHATHENE you specify:—

HIGHER DIELECTRIC—Polythene insulated cores have a measured insulation resistance more than 100 times that of similar rubber insulated material.

HIGHER VOLTAGE INSULATION—High voltage tests on Ashathene Cable show a factor of safety 1.6 times greater than the equivalent rubber insulation on the same size of cable.

BETTER FIRE RESISTING QUALITIES—The P.V.C. used on the sheathing of Ashathene will not support or spread a flame and, unlike rubber, is self extinguishing when the flame is removed.

STRONGER MECHANICAL PROPERTIES—Ashathene is a tough flexible cable which is unaffected by climatic conditions. Compared with rubber, polythene insulated conductors will withstand over twice the mechanical pressure without an electrical failure occurring.

Ashathene is manufactured in all standard sizes and also S.W.A. and D.W.A. classes. Please send for details and lists.

Ashathene THERMOPLASTIC INSULATED **Cable**

A Product of :—

AERIALITE LTD · STALYBRIDGE · CHESHIRE

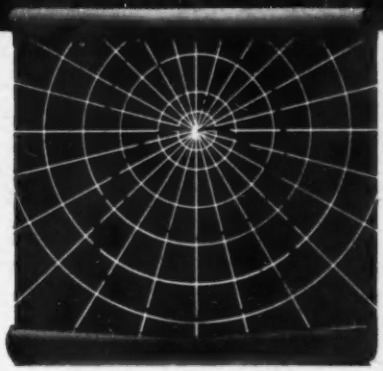
17

VAPOUR PROOF • DUST PROOF

Designed for installations where working conditions require fittings which are dust and vapour proof, they are widely used in Chemical Works, Laundries, Coal Handling Plants, Canteens, etc.

These Units use the Holophane system of prismatic glass to direct the light where it is required with maximum efficiency, and they are sufficiently waterproof to permit hosing down for cleaning.

These fittings are but part of a very wide range of Holophane Lighting Units, including Flameproof, Bulkhead, High Mounting and Heavy Duty units for all industrial and commercial purposes, utilising the Holophane system of controlled lighting.



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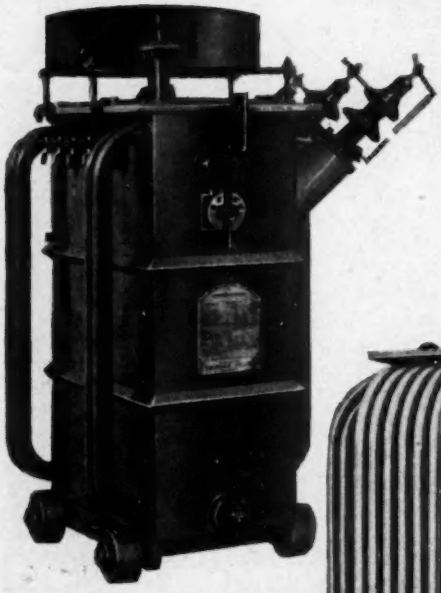
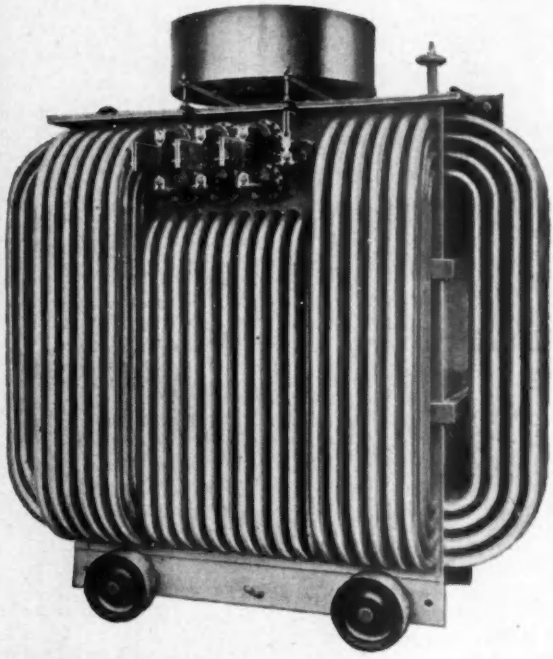
LINDLEY THOMPSON TRANSFORMERS
HERMETICALLY SEALED!



Reliability in service—and therefore maximum safety over the longest period—is the outstanding virtue of Lindley Thompson Transformers. Large numbers of **Thompson Relief Chambers** have been in service for a considerable time and have given trouble-free service under damp and humid conditions . . . in India, East Africa, Ceylon, etc. NO MOISTURE or ACIDITY OF OIL, NO SLUDGING OF OIL, NO SERVICE COSTS . . . just perfect all-the-year-round transformer operation.



(above)
100 kVA, 3-phase, 50 cycles. Voltage ratio 11,000/50 Delta/Star fitted with off-load switch.
H.T. Outdoor bare type terminals and arcing horns.
L.T. Outdoor bare type terminals. Thompson Relief Chamber and Protective cover.

(on right)
FOR TROPICAL USE.
1,500 kVA, voltage ratio 6,600 433 volts. Thompson Relief Chamber and Protective Cover.

LTTS Co.

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Advanced technique, careful planning, long experience and team-work are all combined in the manufacture of "Scottish" Domestic Cables complying with the latest British Standards. Our Rubber Insulated Cable Catalogue illustrates the wide range of cables available from stock.
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More light for every penny spent!

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EFFICIENCIES INCREASED BY

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SIMPLICITY, ROBUSTNESS and EASY JOINTING—these are outstanding features of HENLEY Modern (Group 24) Distribution Pillars. Every detail in their design is based on our unrivalled experience in the production of electrical distribution equipment.
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Group 24
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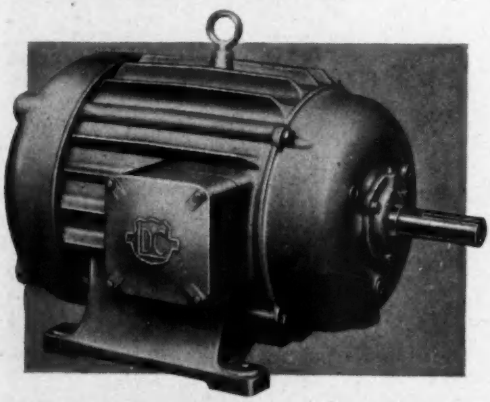
BRITISH STANDARD DIMENSIONS

LDC 'FANKULD' MOTORS

... for Increased Productivity and Lower Maintenance Costs!

Motor interchangeability ensured by standardized dimensions, at the same time the well-known L.D.C. constructional features are retained.



OTHER ADVANTAGES OF L.D.C. 'FANKULD' MOTORS (B.S.D. Type) include:—

- Absolutely dust-tight.
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- Specially designed, high efficiency fan ensures adequate cooling.
- Flange mounting motors available with standard, type 'D', N.E.M.A. flanges, the size lining up with corresponding N.E.M.A. H.P. frames.

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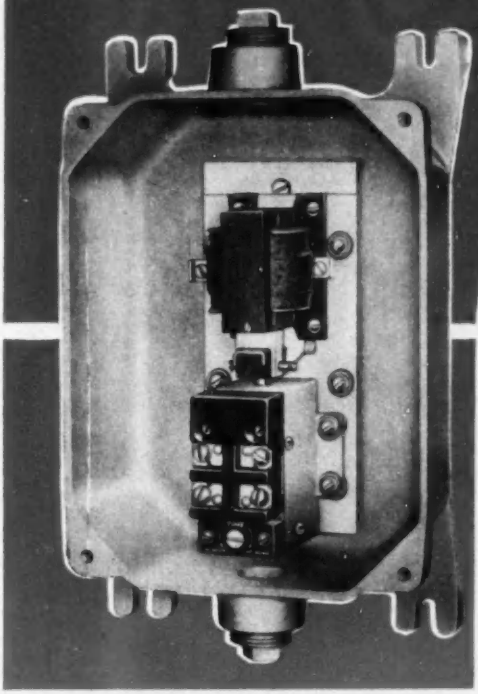

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This single-pole change-over switch, in which 'make' or 'break' timing can be set to operate over a range of 1/6th to 180 seconds, comprises a compact pneumatic system and a robust solenoid mounted in a fully-tropicalised case of cast-aluminium.

Comprehensive technical data gladly forwarded on request.

Now available for PROMPT DELIVERY

It is used for

controlling accelerating-contactors of motor starters; timing the opening and closing of valves in refrigeration plant; controlling sequential process operations; and for the delayed-starting of loop-circuit electrical equipment.

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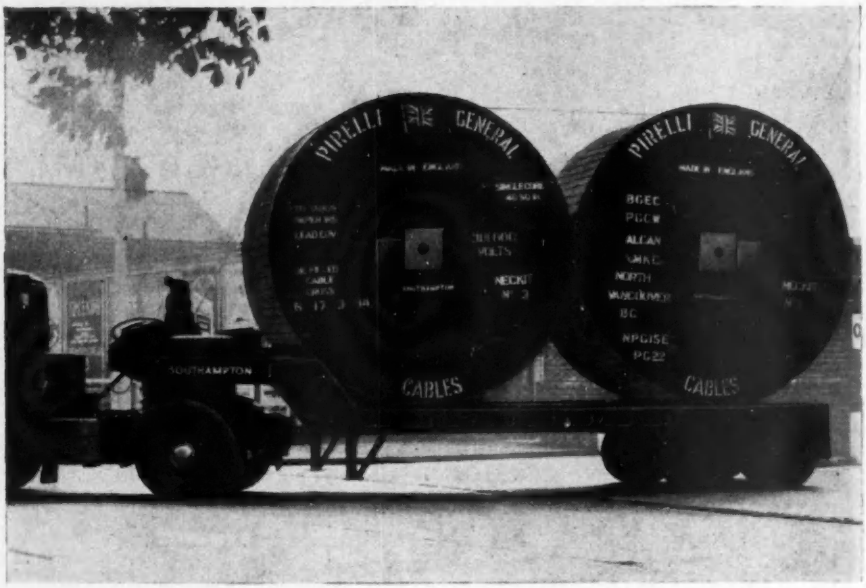

Cables for Canada.....

but it might have been any other quarter of the globe—for Pirelli-General cables are in use all over the world. Here is some of the 301,000 V oil-filled cable that is being supplied to the Aluminum Company of Canada Ltd. It will be used to transmit the power developed by hydro-electric generators in a subterranean power house built in the interior of a mountain at Kemano, British Columbia.

PIRELLI-GENERAL *Cables*

MANUFACTURERS OF EVERY KIND OF ELECTRICAL CABLE

PIRELLI—GENERAL CABLE WORKS LTD., SOUTHAMPTON
(Associated Company of The General Electric Co. Ltd.)

TYPE V.O.30

DIRECT-ON-LINE AUTOMATIC CONTACTOR STARTER

A complete range of **Motor Control Gear** in individual or group arrangements in single, double or triple tier formation up to 650 volts A.C.

- **Interlocked Isolation**
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the **Belmos** *company limited*

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SPEEDFIX **P.V.C.** (Polyvinyl Chloride)
A good insulator and a versatile electrical tape.

1. Thin, strong, pliable. 2. Moulds to shape under tension of application. 3. Resistant to oils, acids and moisture. 4. Withstands weathering and extremes of heat and cold. 5. Does not discolour or corrode copper. 6. Available in colours and also printed.

SPEEDFIX **INSULATING TAPE**

1. Six coatings. 2. Pure rubber adhesive only: on BOTH sides. 3. Clean to handle. 4. Does not dry out. 5. No pin holes. 6. Dielectric strength 1,500 V. 7. Two-year storage guarantee on every roll.

Free samples gladly sent on request.

INDUSTRIAL TAPES LTD.
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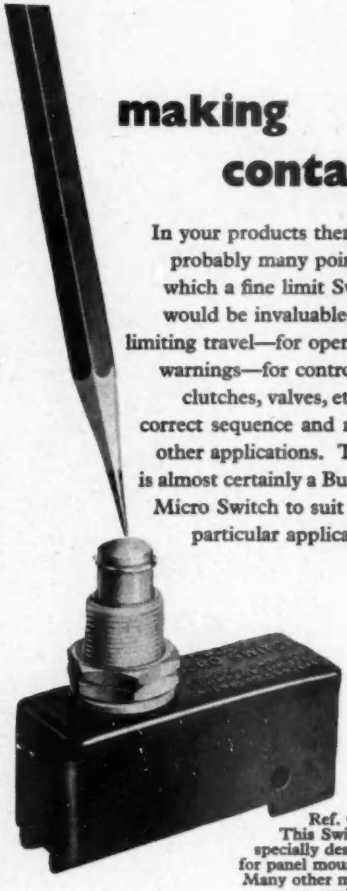

making contact

In your products there are probably many points at which a fine limit Switch would be invaluable—for limiting travel—for operating warnings—for controlling clutches, valves, etc., in correct sequence and many other applications. There is almost certainly a Burgess Micro Switch to suit your particular application.

Ref. CRQ.
This Switch is specially designed for panel mounting. Many other models are available.

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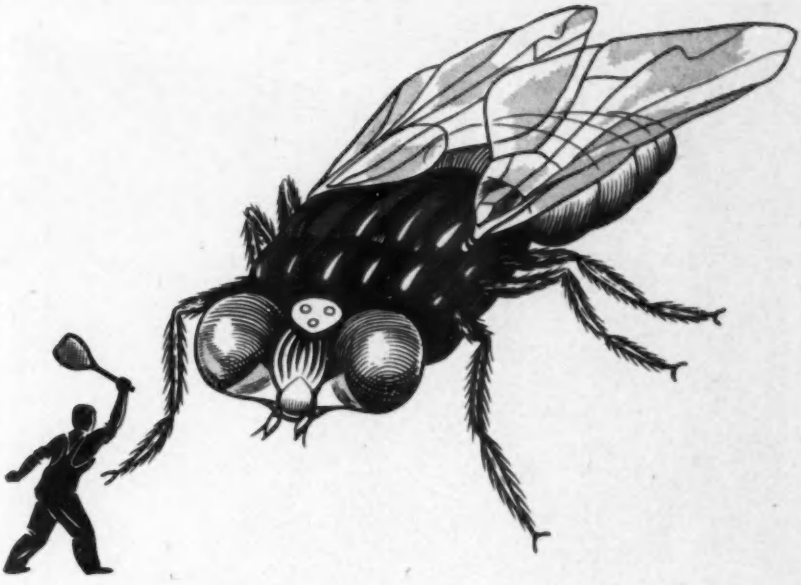

a fly in the ointment . . .

When difficulties in the design and manufacture of plastic components threaten your smooth-flowing production schedule, let Metropolitan Plastics know. They will solve your problems quickly, expertly and at reasonable cost.

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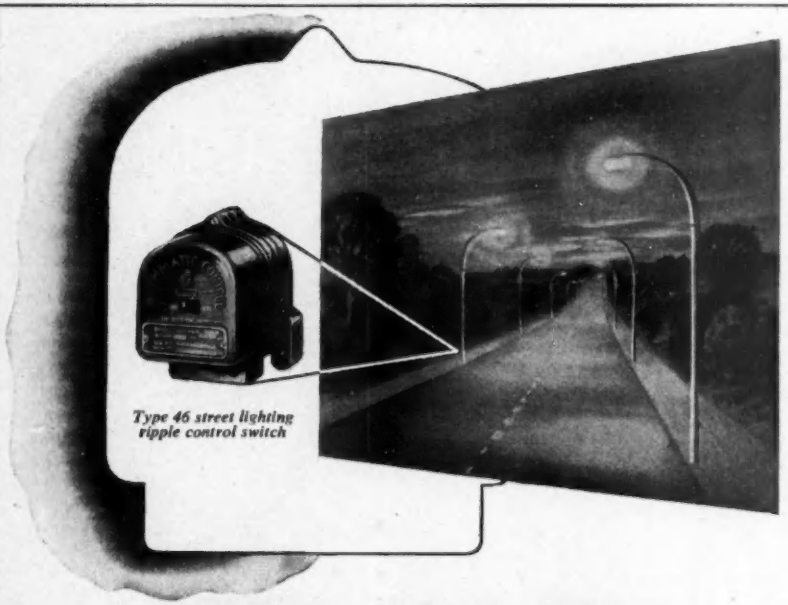

Type 46 street lighting ripple control switch

Highway Authorities
can rely on "Rythmatic" ripple control

Where "Rythmatic" ripple control equipment is installed the street lights under its control are illuminated simultaneously; the switching signals are injected by push-button from the street lighting department. As a number of signals are available, lights may be switched on in groups to suit half night, all night or prior dawn conditions.

Bollards and direction indicators may be separately controlled. It takes only 30 sec. from pressing the button to the lighting of the lamps and the operation can be performed at any time of the day or night. "Rythmatic" ripple control is thus a major contributor to road safety at all times.

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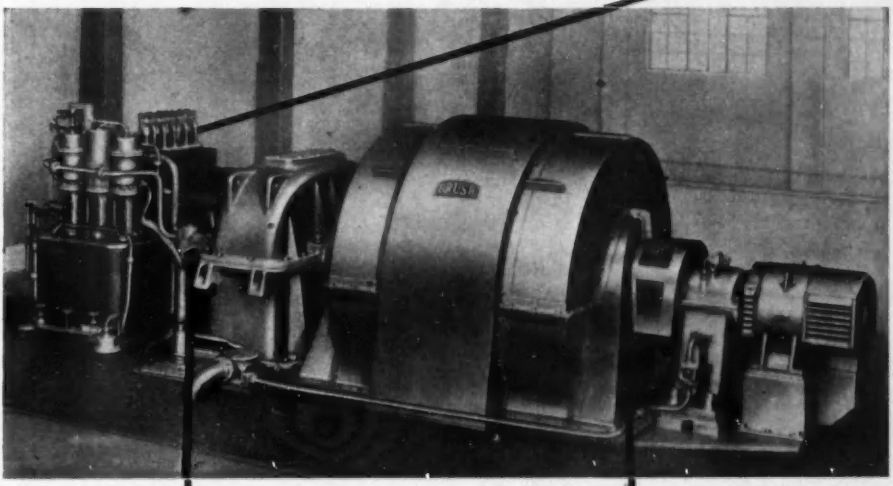
Dual purpose STEAM



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POWER

If you use steam for space heating or processing it may be possible to generate your Electric Power without increasing your fuel bill by installing a Back Pressure Turbine.

A BRUSH Back Pressure Turbo-Generating Set can make your steam perform a double duty.

Our engineers are at your service for further information.

Back pressure Turbines by BRUSH

THE BRUSH ELECTRICAL ENGINEERING CO. LTD. LOUGHBOROUGH, ENGLAND

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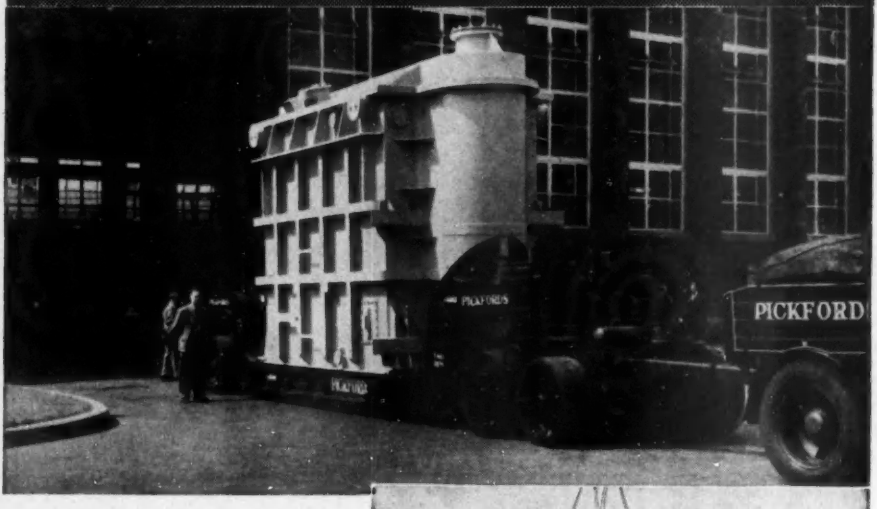
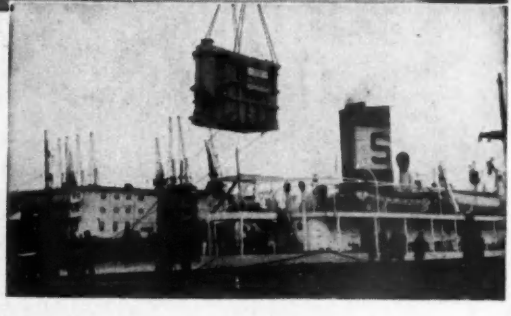
301,400 volts

HIGHEST EVER





The first of four 71,000 kVA 301,400 volt—THE HIGHEST EVER MADE IN BRITAIN—singlephase Ferranti Generator Transformers for the Alcan Project, Canada has been shipped to Kemano, British Columbia. Three 37,000 kVA, 275,000 volt step down Transformers are also being supplied for use at Kitimat.

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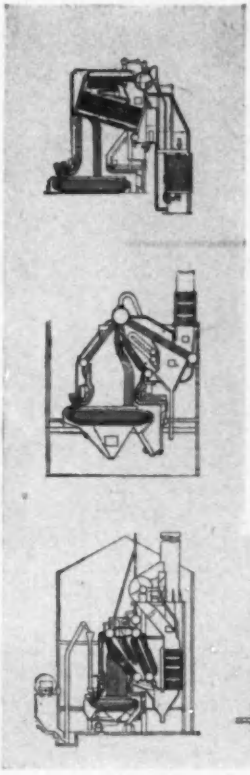

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For every known design and size of water-tube boiler there is a highly efficient 'L' type travelling grate stoker.

- *Close control of air supply*
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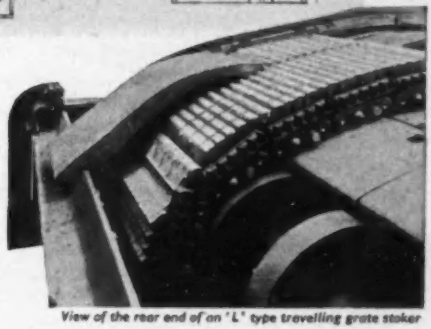
- *Burns efficiently any fuel from refuse to anthracite*
- *Remarkably low maintenance, with parts requiring attention easily accessible*

Please apply for full technical data



View of the rear end of an 'L' type travelling grate stoker

The result of Enterprising Engineering by ICL

INTERNATIONAL COMBUSTION LTD.

LONDON OFFICE: NINETEEN WOBURN PLACE, W.C.1. Works: Derby, England; Port Elizabeth, South Africa; Sydney, Australia.

Dependable small-power drives

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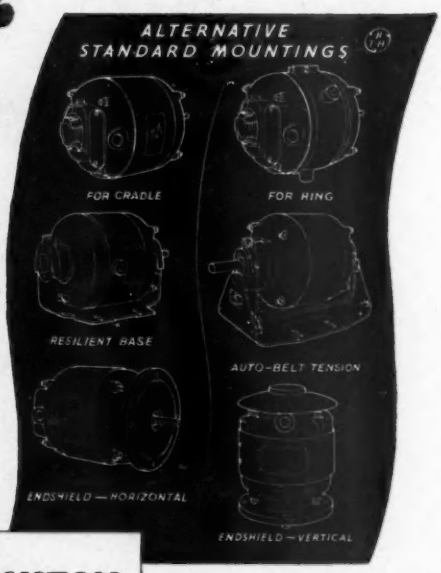
FRACTIONAL - HORSEPOWER MOTORS

The endless processes which make up the industrial pattern demand a reliable source of motive power. In the multitude of applications where an electric motor drive of between one thousandth of a horsepower and one horsepower is required, BTH "fractionals" provide economic service with the minimum of maintenance.



Single-phase	*1/8 to 1 h.p. up to 250 volts, 25 to 100 cycles.*
Three-phase	*1/6 to 1 h.p. up to 550 volts, 25 to 100 cycles.*
Direct current	*1/8 to 1 h.p. up to 520 volts.*

Many sizes can be supplied from stock.

For low-speed drives a comprehensive range of geared motor units is available.

All BTH fractional-horsepower motors comply in every respect with British Standard 170.

THE
BRITISH THOMSON-HOUSTON
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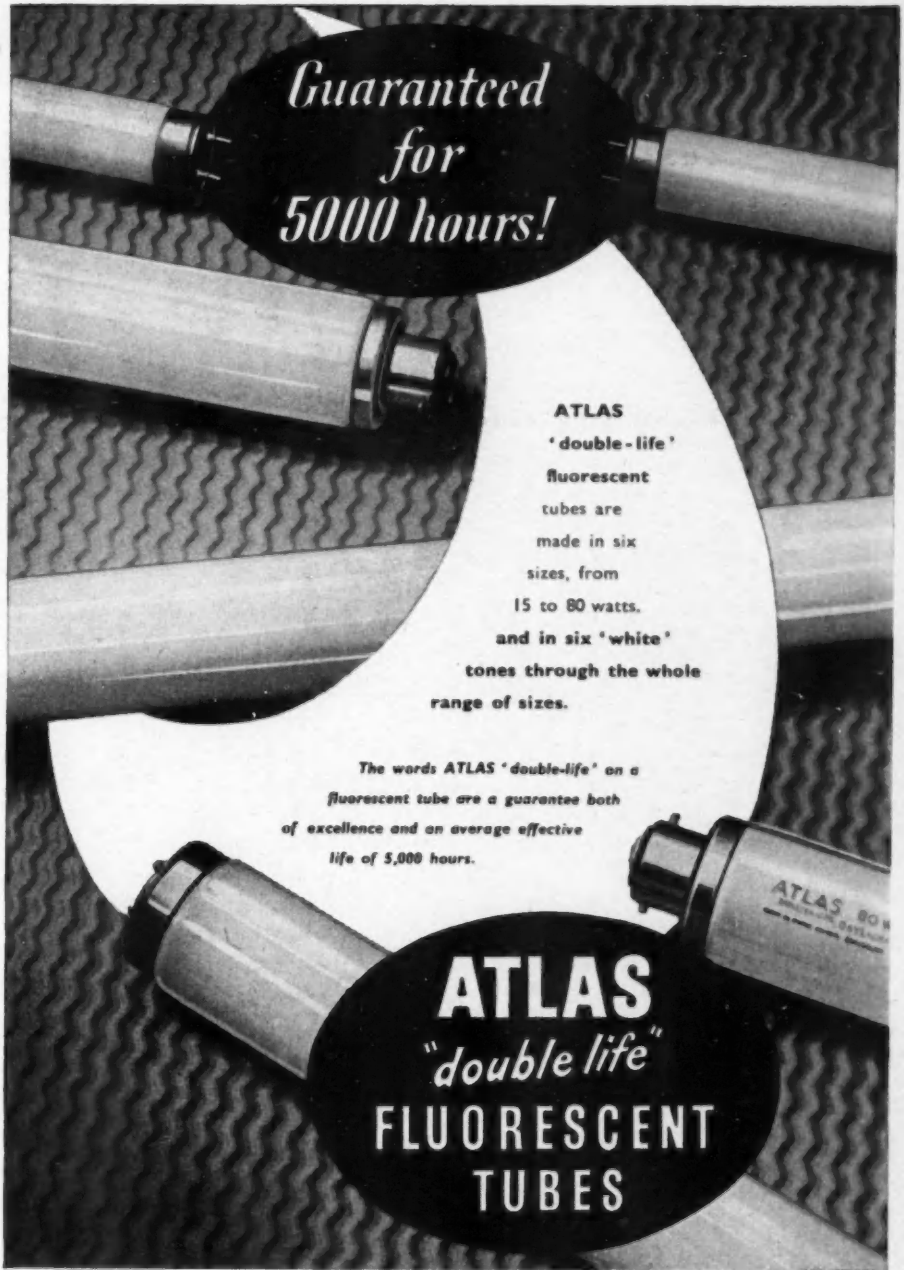
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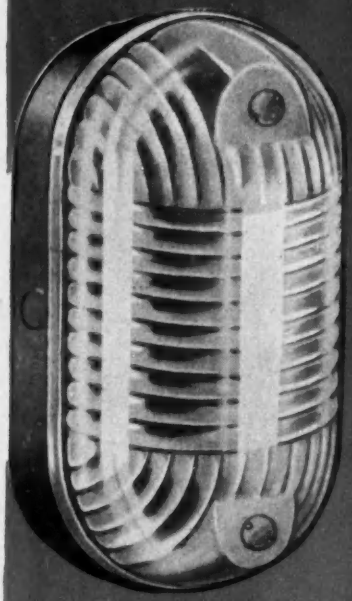
ATLAS 'double-life' fluorescent tubes are made in six sizes, from 15 to 80 watts, and in six 'white' tones through the whole range of sizes.
The words ATLAS 'double-life' on a fluorescent tube are a guarantee both of excellence and an average effective life of 5,000 hours.
ATLAS
"double life"
FLUORESCENT
TUBES

Thorn THORN ELECTRICAL INDUSTRIES LTD., Lighting Division, 233 Shaftesbury Avenue, London, W.C.2



new—inexpensive—
and just what's wanted!

CORRILUX

BULKHEAD FITTING
for 60 w. *and* 100 w. lamps

This versatile new lighting fitting from the House of Simplex is sure of a good reception from architects, surveyors, electrical engineers—everyone concerned with efficient, economical, versatile lighting

CORRILUX has every good point

- The one unit suitable for surface or semi-recessed fixing
- Takes all G.F. lamps up to 100w
- Top, bottom, side or back entries at no extra charge
- Excellent general illumination with minimum glare
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- Secret key operation prevents tampering
- Unique method of fixing front glass assures even pressure on gasket all round and gives unusual weather and dust proofing
- Packed in cartons of 6 for convenient stocking

and the price only 27/-

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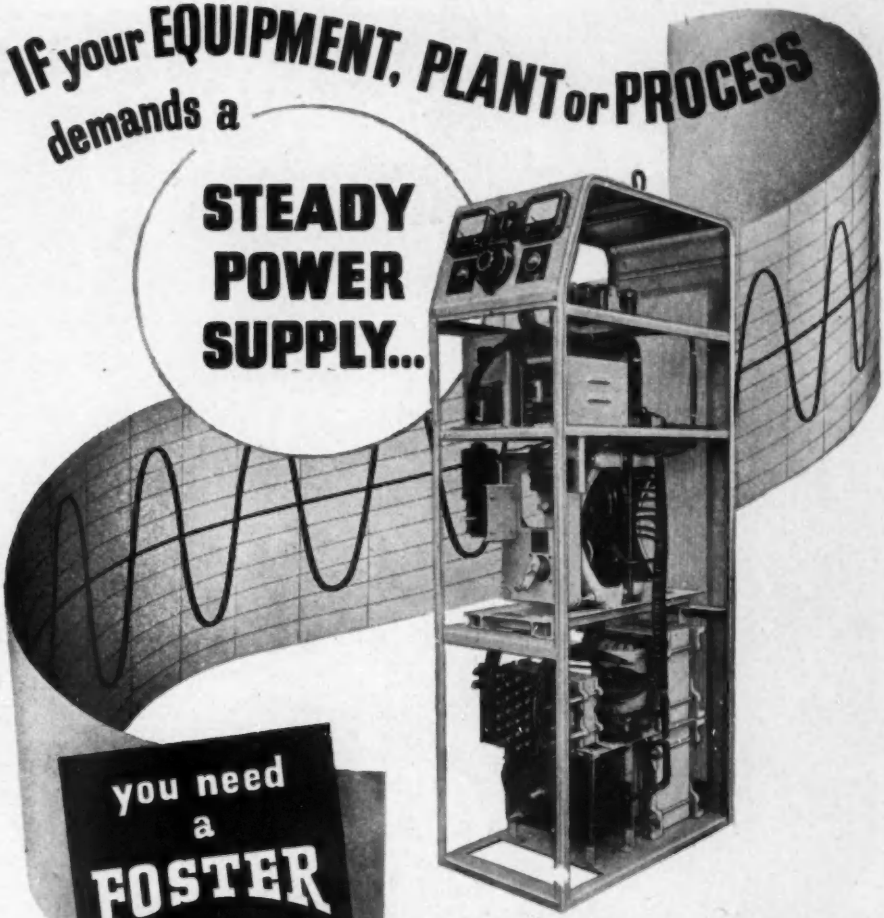
IF your EQUIPMENT, PLANT or PROCESS demands a STEADY POWER SUPPLY...



you need a FOSTER AUTOMATIC VOLTAGE REGULATOR

Regulators similar to that illustrated above have been supplied to diverse industries in sizes ranging from 10 kVA to 400 kVA. In addition to which, many special types of regulators have been designed for building into customers' own equipment. Our specialist engineers would be glad to discuss your problems and perhaps show you where the efficiency of your plant can be improved by ensuring a "Steady Power Supply".

It pays to solve Voltage Problems before they happen!

FOSTER TRANSFORMERS LTD. SOUTH WIMBLEDON LONDON S.W.19

A 'LANCASHIRE DYNAMO HOLDINGS' COMPANY

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Another Featherweight Cable

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Single and Multi-pair Telephone Distribution Cables—Copper Conductors—Insulated with Polythene-Cores coloured for easy Identification—Polythene Taped—Screened with Aluminium Tape—Protected with a sheath of Polythene—for direct burial in the ground. A further protection comprising two impregnated cotton braidings can be provided where the cable is to be suspended overhead from a Catenary. Joint boxes are available for all sizes of cable.

STERLING CABLE COMPANY LIMITED
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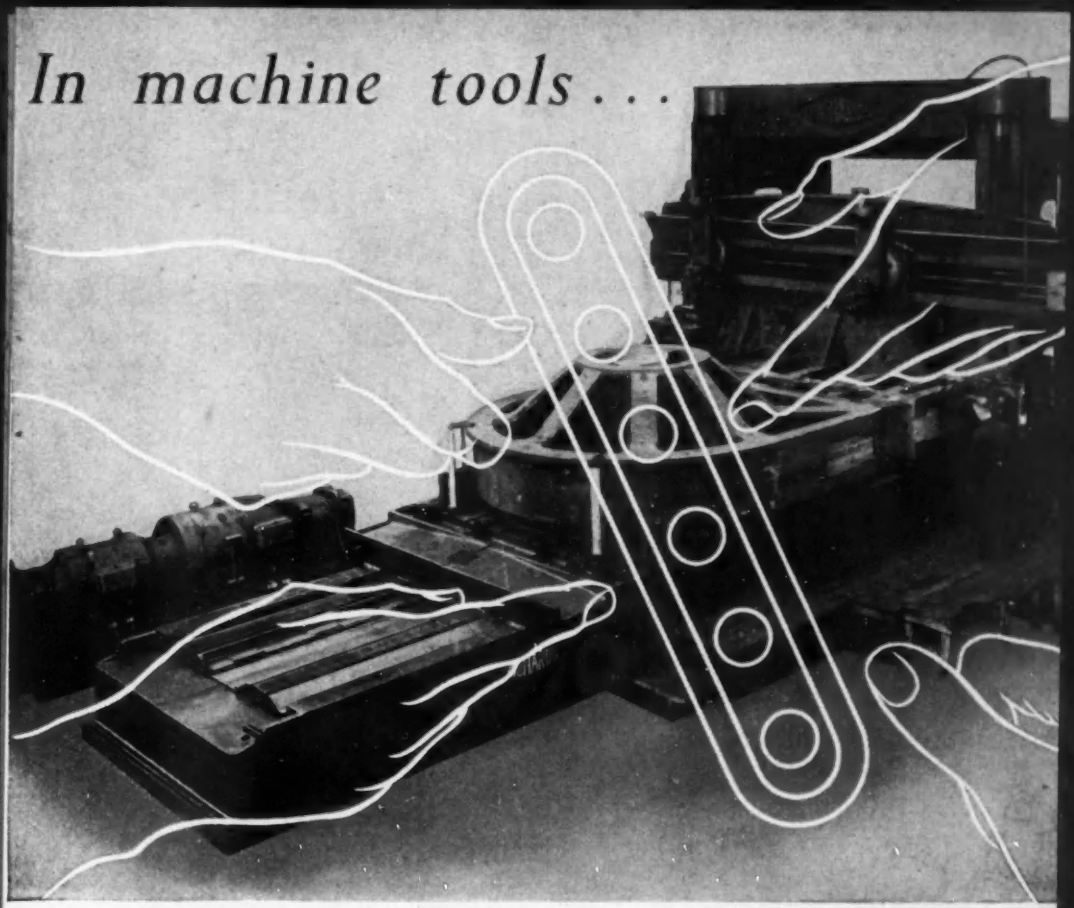

Push Buttons for Productivity

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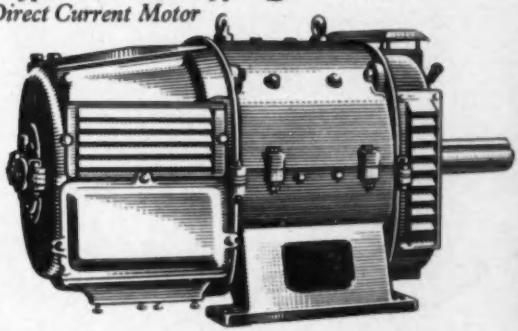

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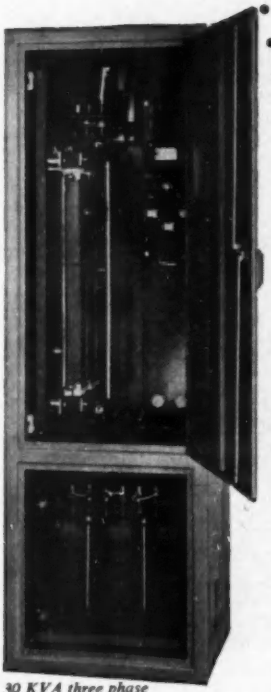

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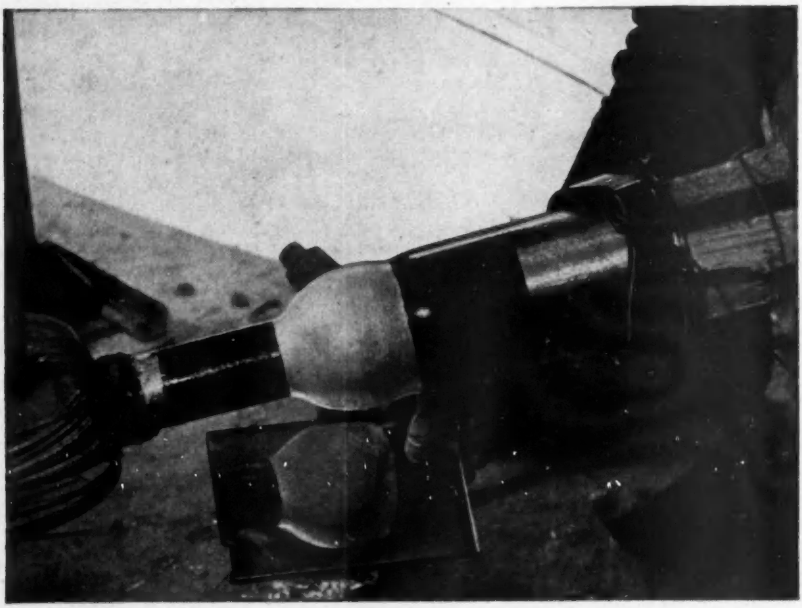

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ELECTRICAL TIMES

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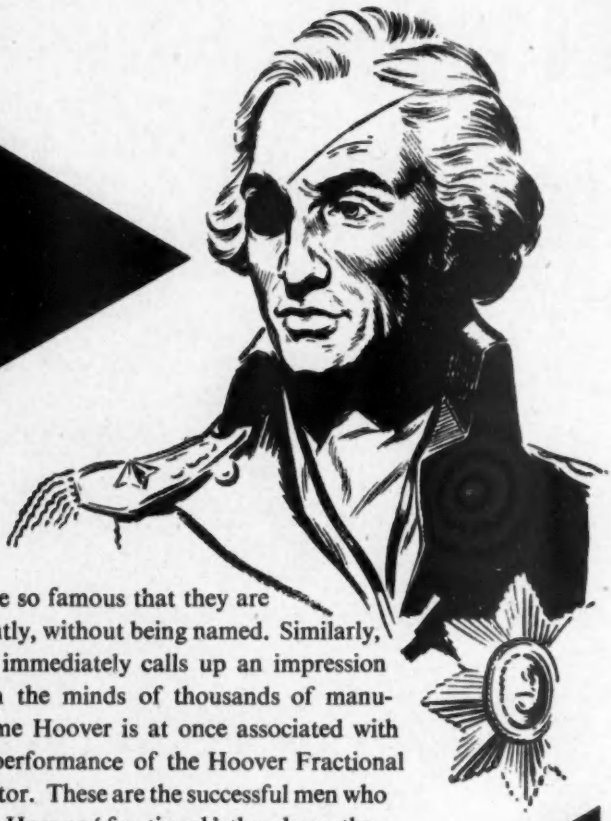
THE POWER OF A NAME



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Editorial

QUALITY BEFORE COLOUR

PAST months have seen much correspondence and comment in the daily papers on various aspects of road lighting as a factor in road safety. In many ways this is a desirable development, since popular interest may eventually make possible technical improvements by voting the money for them, but uninstructed criticism has inevitable drawbacks. Mr. C. C. Smith did well to apply a corrective to some wild statements on the subject in his lively presidential address to this week's conference of the Association of Public Lighting Engineers. In particular, he dealt effectively with the thorny question of different systems of lighting—tungsten, sodium and mercury vapour, and fluorescent—whose succession along a stretch of road seems so annoying to many road users. He found, indeed, some merit in this non-uniformity. Provided it is not carried to excess and, above all, that each of the succeeding schemes is of the highest quality, there should be no danger and some advantage. In short, he called for uniformity of quality rather than type; a subtle distinction, but one of considerable importance. As readers of the summary given later in this issue will find, he extended this admirable precept to aspects of road lighting beyond the light source itself.

DEFINING GOOD LIGHTING

IN such lighting matters it is always far easier to talk in general terms of quality, than to specify precisely what is meant. It has been the experience in all fields of illumination engineering during recent years, that the measurement of foot-candles has been discarded as the prime test of quality, its place being taken by the largely subjective evaluation of a less tangible set of concepts, involving brightness and glare. Though less amenable to direct measurement these ideas do in fact fit in better with the judgment of the excellence of a scheme which experience suggests, and they are extending into road lighting science as into other fields of illuminating engineering. Their full complexity in this application was discussed in a conference paper which had a strong international flavour, and which carried the criteria for good lighting from generalised statements into mathematical formulae, and used these to evaluate the contrasting merits of British and Continental practice in the lighting of traffic routes.

MACHINE TOOL CONTROL

IN an exhibition dealing with machine tools, electricity naturally must play second fiddle, but in the recent Brussels Fair the number of electrical exhibitors was so small that they failed to reflect the vital part that electricity is playing in machine tool design. In consequence, the display was hardly adequate in presenting to machine tool designers a picture of the extensive facilities that electricity can provide. The need for such education was clear in more than one exhibit, where complicated mechanical controls were used for tasks which could be done more simply by electrical means. The time has come when electricity must be regarded as something much more than a convenient source of power, and for the more complicated automatic machines a combined electro-mechanical approach should be made from the start. Examples of the fruits of such an outlook were to be seen at the exhibition, but they were distinctly rare. Unquestionably, with the ever growing demand for automatic machine tools, the trend must inevitably be towards this direction. Thus our machine tool designers must not only be made familiar with the

full facilities of electrical control, but be convinced of the effective part electro-mechanical methods can play in automatic operation, so that expert electrical advice is obtained early in a design development.

ANALOGIES CAN HELP

FOR most students of mechanical engineering, electrical technology is a compulsory subject unreasonably demanded by examiners, but having no real importance in their future careers. Later they will find that they are mistaken in their view, but by then the shallowly imbibed knowledge of volts and amps will have been lost, unless imaginative teaching has fixed it more deeply than usual in the student's mind. To attain this result is the more difficult in that the teaching of electrical subjects usually falls, not unreasonably, to electrical engineers, who are somewhat suspect by the embryo mechanicals. Familiar techniques are perhaps the safer choice when faced with such a problem, and the use of mechanical analogies can help maintain the interest of the student where it might otherwise wander. This theme is developed to a somewhat advanced level elsewhere in this issue this week but it has many simpler applications which come to mind, and which are well worth consideration by the many electrical engineers who give up part of their spare time to technical college teaching.

LIGHTING HARMONICS

SUPPLY authorities, whose aim it is to generate and distribute an undistorted sine wave voltage, find that the circuit characteristics of the fluorescent lamp produce undesirable harmonics which may overload neutrals and appear as terminal voltages. Indeed, the rapidly growing number of fluorescent installations is bringing the problem into some prominence, and could lead to the eventual need for drastic suppressive action. This, fortunately, is becoming less likely, for increasing insight into the mechanics of harmonic production is making possible a simpler solution. An article on a later page explains the involved interplay of many factors which determines the waveform of the current drawn by a fluorescent lamp, and from this study it can be seen that careful control-gear design can do much to diminish the magnitude of harmonics, with consequent reduction in the disturbance injected into the supply mains. As so often happens, there is a conflict here between price and performance: control-gear that can reduce harmonic disturbance is generally more costly than that which will merely ensure satisfactory operation of the lamp, as a light source. Yet the user who avoids the cost of corrective control-gear may well find a heavier sanction applied at some future date by supply authorities seeking freedom from harmonics.

RIGID TARIFFS

IT is not easy for a supply authority nowadays to favour a deserving customer on grounds of common practice and public interest. Preoccupation with simplifying tariffs has meant that the church, the village hall, and many another similar establishment, often kindly treated by pre-nationalisation concerns, has had to fit into the tidy three-way classification of industrial, commercial or domestic. As they are obviously non-domestic and non-industrial, they have become, by some abstruse exclusion principle, commercial premises for tariff purposes, chargeable as such to the full extent that the all-levelling published tariff allows. To obtain any modification of this patently absurd arrangement has needed a long fight, for there are many superficial attractions in a policy of out-and-out tariff simplification, but changes are at last being made, thanks to the persistence of consumers councils. Yet even these relaxations are being admitted only on a closely - argued basis of load incidence, with no regard for the special position of such institutions in the community. The law - bound nationalised undertaking, it is becoming increasingly obvious, leaves little scope for its officers to exercise the English characteristic of illogical but successful compromise.

Meteor

Discharge Lamp Waveforms

The Generation of Harmonics by the Fluorescent Lamp and its Practical Importance to Supply Engineers

By C. E. WILLIAMS, B.Sc., A.Inst.P. (Research Laboratories, General Electrical Co.)

THE operation of fluorescent lamps cannot be adequately described in the familiar terms appropriate to sinusoidal electrical systems. For example, devices such as the vector representation of currents and voltages are frequently unsuitable for use without modification, in problems concerning these lamps, and the widespread use of the fluorescent lamp has resulted in the need for a more general practical understanding of the interesting non-sinusoidal behaviour which it exhibits.

Discharge and Tungsten Lamps

Let us first make a comparison between the physical conditions within an incandescent lamp and a discharge lamp such as a fluorescent tube. In a tungsten filament lamp operated from a sinusoidal supply of frequency 50 c/s, the temperature of the filament attains a nearly constant value. The rate of supply of heat throughout the cycle is not constant but the variation of temperature is small because of the filament's thermal capacity. This results in a nearly constant filament resistance and therefore the instantaneous current is practically proportional to the instantaneous lamp voltage and both will be approximately sinusoidal.

On the other hand, the resistance of a discharge lamp is markedly variable even when normal operating conditions have been reached. Before the discharge is initiated the conductivity of the gas or vapour filling is extremely small. When the arc has been established the resistance is much reduced due to the presence in the vapour of positively and negatively charged ions. These are able to move under the influence of the applied electric field and the resulting drift of electric charge constitutes an electric current. Clearly, the ease with which a current flows is dependent upon the number of ions present. The resistance of the discharge is high when

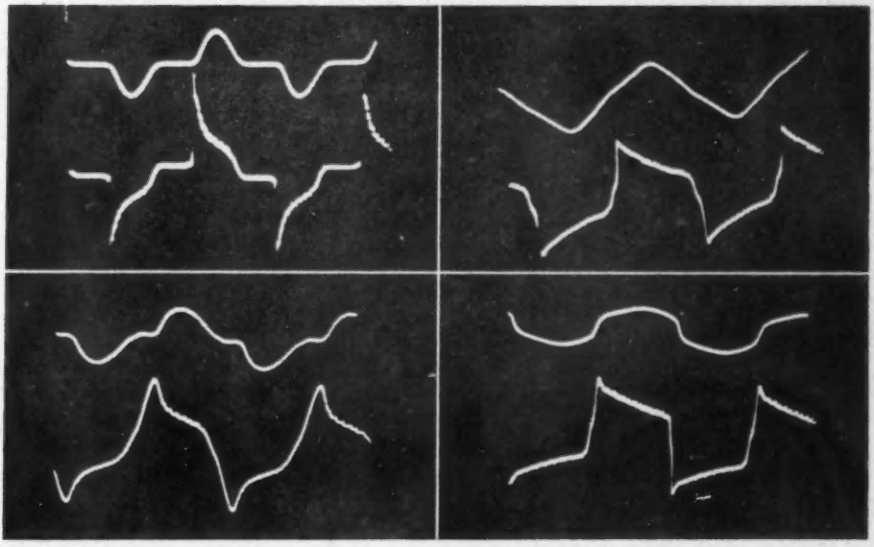


Fig. 1.—Typical curves of lamp current and voltage traces for an 80 W lamp. In each case the upper trace shows the current and the lower the voltage waveform

the ions are scarce, and low when they are abundant.

The factors controlling the degree of ionisation are many, but the collision processes occurring within the gas are a major source of ions. A collision between a rapidly-moving charged particle and a neutral atom may result in the ejection of (negatively charged) electrons from the atom, leaving the atom with a net positive charge. The rate of production of ions in this way clearly depends on the lamp current. It can be seen that a variation in the number of ions present may be expected throughout the cycle of current. The resistance of the discharge is, therefore, not constant. The intervention of many other factors makes the theoretical determination of ion density exceedingly complex and in general it is not yet possible to predict accurately the variation of lamp resistance. Because of it, however, a sinusoidal voltage impressed across the lamp will not usually produce a sinusoidal current, and vice versa. This could only happen if the resistance of the lamp were to remain constant. In ordinary lamp circuits neither the lamp voltage nor the lamp current is sinusoidal. For a given type of lamp, under perfectly steady conditions, every possible lamp current waveform of given magnitude will give a definite and unique lamp voltage waveform, which will not be given by any other lamp current wave. Some examples are given in Fig. 1. This relationship will hold quite independently of the nature of the external circuit and is a property of the lamp itself.

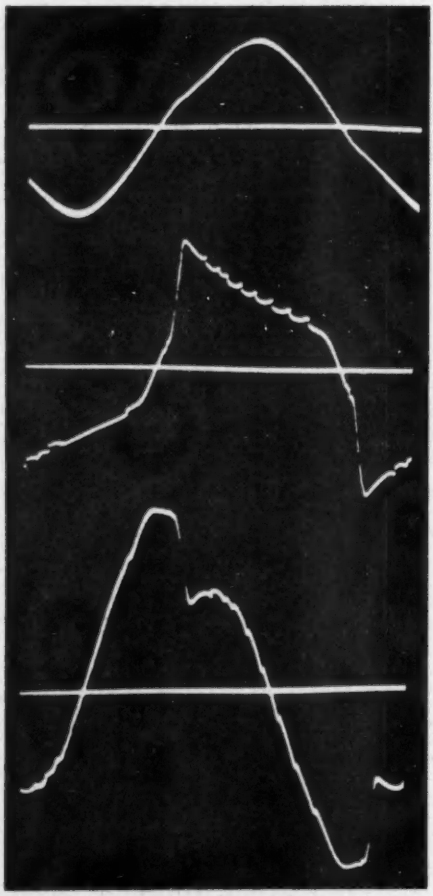


Fig. 2.—Lamp current, lamp voltage and choke voltage (from top to bottom respectively) for an inductively ballasted lamp

In practical lamp circuits there will be some form of impedance in series with the lamp. The lamp waveforms will then adjust themselves so that the intrinsic lamp requirements are satisfied, and at the same time the instantaneous currents and voltages are compatible with the characteristics of the external circuit. In other words, an infinite number of different lamp current waves is conceivable, each with its own characteristic voltage wave. From this infinite number there is only one current waveshape which will give rise to a voltage drop in the external circuit resulting in the appropriate voltage wave across the lamp.

Practical Waveforms

In the study of practical waveforms with an oscilloscope, the correlations between the lamp, ballast and supply voltages, and between the ballast voltage and current are easily followed. The final link in the chain is the relationship between the lamp voltage and current. This presents problems due to the complexities which have already been described, and the best that can be done at present is to give a simplified explanation.

Let us consider a lamp ballasted by means of a series choke. The practical waveforms which occur are shown in Fig. 2. The characteristic feature of the choke voltage waveform is the sharp indentation of the wave. This can be related to the rapid change of lamp voltage from a large negative value to a large positive value. Thus the rapid change of voltage across one circuit element is matched by that across the other, so that the overall voltage drop still balances the supply voltage. Examination will show that

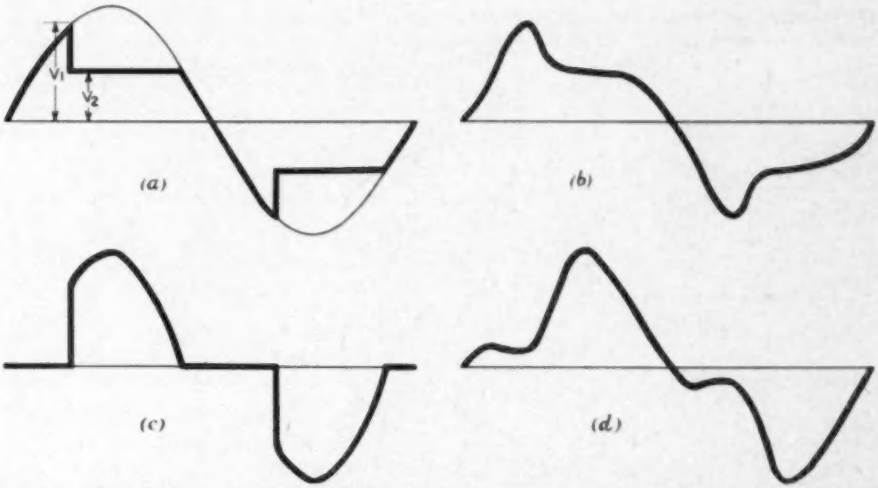


Fig. 3.—Wave form for a resistively ballasted lamp. (a) Arbitrarily assumed lamp voltage waveform. (b) Experimental lamp voltage waveform (from an oscillogram). (c) Current waveform derived from (a). (d) Experimental current waveform (from an oscillogram)

at every point in the cycle, the algebraic sum of the lamp and ballast voltage is equal to the supply voltage. Again, assuming the choke to be unsaturated, the voltage across it will be proportional to the rate of change of current, that is, the slope of the current wave. Study of the figures will again show that this is indeed true. The sudden fall in choke voltage corresponding to the reversal of the lamp voltage, has its effect in the current wave in the region of zero current. Here the rapid change of *slope* of the current trace corresponds to the rapid change in *height* of the choke voltage trace.

The peak of lamp voltage is known as the "lamp restarting voltage," to distinguish it from the "lamp starting voltage," which refers to the initial establishment of the arc. This distinction is necessary because there are very few ions present during the initial establishment of the arc, whilst appreciable ionisation persists through the lamp restarting period in each cycle. Nevertheless, there is usually a substantial reduction in the number of ions present in the discharge column. This is attributable to the loss of ions by recombination and diffusion, without appreciable production of new ions in the low current period. The peak of restarting voltage and the associated high lamp resistance arise from the relative scarcity of ions at this instant.

The small oscillations superimposed on the remainder of the lamp voltage wave are not yet fully understood. As one would expect, these minor indentations also appear in the choke voltage wave. Their effect on lamp current is not noticeable since a number of small changes of slope are produced in alternate directions. Over the half cycle these effects nearly cancel each other out.

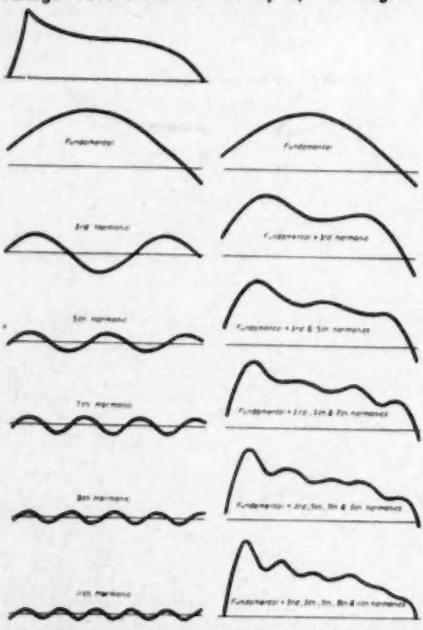
If a mean lamp voltage wave lying midway between the indentations is considered, it will be seen that the voltage remains fairly constant over a substantial part of the cycle. This indicates that the instantaneous resistance varies approximately inversely as the current. This is a reasonable conclusion from the ionisation standpoint.

The Effect of Circuit Changes

Fig. 1 shows a number of oscillograms of lamp voltage and current taken on the same lamp in different circuits. These show that although the voltage waveforms differ in detail they have the same general shape. They may all be approximately represented by a single idealised wave of rectangular form modified by the addition of an initial peak and a sloping tail. (Fig. 3 curve a). This enables a very rough prediction of the behaviour of new and experimentally untried combinations to be made. Of course this assumption of a particular lamp voltage waveform is entirely arbitrary and is only justified by the fairly successful results.

As an example of this procedure we may consider a fluorescent lamp with resistive

Fig. 4.—Harmonic components of the assumed voltage wave shown at the top of the diagram



The major harmonic components are shown separately in the left-hand column, and the result of their successive addition to the fundamental is given in the right-hand column. For demonstration purposes a wave is chosen having substantial high harmonics. Closer approximations to the original wave can be obtained by taking further harmonics into consideration

ballast. Assume the lamp restarting voltage peak to be V_1 volts and the running voltage to be V_2 volts (Fig. 3, curve a). Suppose that the lamp current is zero at the instant of restarting. Then the volt drop across the resistor will be zero and the lamp restarting peak will be equal to the mains voltage, as shown in the figure. Immediately after restarting the lamp voltage will fall to the value V_2 and the difference between the lamp and supply voltages will be absorbed in the resistor. The current flowing will, of course, be proportional to the voltage across the resistor. It is assumed that current will cease to flow when the mains voltage has fallen below V_2. In this way an estimate of the waveforms can be made. The results of this procedure shown in Figs. 3a and 3c may be compared with the measured waveforms in Figs. 3b and 3d. The degree of correspondence is fair. Of particular interest is the existence of an extended period of small current, the so-called "extinction period."

The complex processes within the discharge give rise to unique relationships between pairs of voltage and current waveforms of given magnitude, but the general laws of such relationships are obscure and at present imperfectly understood. The waveforms occurring in a specific circuit are determined by the fact that of all the related pairs of lamp V-I waveforms, only one pair will also fit the requirements of the external circuit. It is possible to predict approximately the performance of untried combinations by making arbitrary, but plausible assumptions about the lamp voltage wave.

Nature of Harmonic Components

The fact that the current drawn by discharge lamps is usually non-sinusoidal is often expressed by the statement that harmonic current components are present. A few words on the nature of harmonics may perhaps be helpful.

A repetitive current wave of any shape may be regarded as being produced by the simultaneous flow of a number of sinusoidal currents of various frequencies, amplitudes and phases. Voltage waves may be regarded in a similar way, except that in this case potentials must be regarded as being superimposed on each other. Fourier showed that in general the frequencies of the components are all integral multiples of the lowest frequency. This is illustrated in Fig. 4, where the result of successive addition of several harmonics to a fundamental is shown. The harmonics have been chosen to be of such magnitude and phase that the resultant wave is a close approximation to the voltage wave for a lamp with a certain type of ballast. This is also shown in the diagram. The approximation can be made as close as desired by taking a sufficiently great number of harmonics but usually the higher frequency components are negligible.

The mathematical manipulation required for the evaluation of the appropriate amplitudes and phases of the various components sometimes fosters the impression that the existence of harmonics in non-sinusoidal waveforms is a mathematical fiction. This is true to the extent that the desired components are arbitrarily assumed to be sinusoidal. It would be possible to analyse the original wave into components of say rectangular form, giving rise to quite different results. Such components could be detected practically, if means of detection were available which were responsive only to rectangular waves. In practice it is convenient to use apparatus which is responsive only to sinusoidal waves.

A linear sharply tuned circuit is an example. Such a device will give a response compatible with the Fourier analysis. Hence the relative importance in this connection, of this type of analysis as compared with other possible systems. The arbitrary element in the Fourier analysis is matched by an arbitrary element in the choice of experimental equipment for investigating the nature of non-sinusoidal waves.

Fig. 5 shows the experimentally determined values of sinusoidal current harmonics for an 80-watt fluorescent tube operated with a certain choke ballast. The amplitudes of the various frequency components are expressed as a percentage of the fundamental (50 cycles per second) current.

Power Factor of a Discharge Lamp

The dissimilar waveforms of lamp voltage and current give rise to a lamp power factor less than unity. When dealing with sinusoidal systems power factor may be defined in two ways which are equivalent. It may be taken as the ratio between true power absorbed and the product of current and voltage, or it may be defined as the cosine of the phase difference between the current and the voltage. In non-sinusoidal systems the equivalence no longer holds and the second definition has no meaning unless it is interpreted as referring to the fundamental components of current and voltage. It seems reasonable to exclude the latter definition on these grounds and also because of the obvious advantage of defining *power* factor in terms of power. This arrangement gives the same definition for sinusoidal and non-sinusoidal systems and obviates the need for the term "apparent power factor."

A circuit element can only have unity power factor if the current and voltage waveforms are identical and coincident. In this condition every harmonic voltage is exactly in phase with the corresponding harmonic current, resulting in the maximum possible power. If, as in the fluorescent lamp, the harmonics in the current and voltage are not of proportional magnitude, or are of different phase, then they will make a greater contribution to the total volt-amps than to the total power. In this way the power factor will fall below unity.

The function of the power factor correction capacitor which is normally connected across the mains in conjunction with a fluorescent lamp circuit is to reduce the line current without changing the wattage consumption of the unit. This it does by drawing a leading current of fundamental frequency from the mains of such magnitude as to neutralise the lagging lamp current component of fundamental frequency. If the supply voltage is sinusoidal the capacitor will carry no harmonic frequency currents and cannot produce unity power factor because it is unable to modify the lamp harmonic currents. Indeed, the percentage of harmonics in the corrected current is greater than in the uncorrected current. This is because the fundamental current and total current are both reduced by the p.f. correction capacitor, whilst the harmonics remain unchanged.

In practice the supply voltage is never perfectly sinusoidal, and the presence of the shunt power factor capacitor produces another interesting effect. An increase in the total harmonic current taken from the supply usually occurs in these circumstances because the impedance of the capacitor is reduced at harmonic frequencies and the mains voltage harmonics are thereby reproduced in the capacitor current in magnified form. Such a mutual reinforcement of the p.f. capacitor and lamp current-harmonics is fortuitous, but occurs in practice to a significant extent. It should be clearly realised that the harmonic currents passing through the shunt capacitor have no fundamental connection with the discharge circuit.

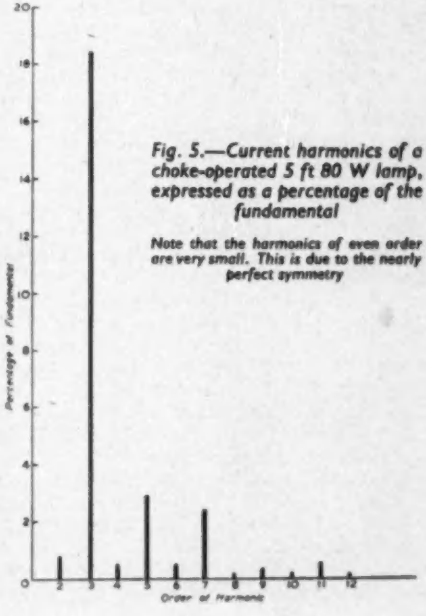


Fig. 5.—Current harmonics of a choke-operated 5 ft 80 W lamp, expressed as a percentage of the fundamental

Note that the harmonics of even order are very small. This is due to the nearly perfect symmetry

It is interesting to note that the power factor of a complete lamp circuit will usually be different from that of the lamp alone, even if a suitable correction capacitor is used. The reason for this is that if a sinusoidal voltage is supplied to the circuit the harmonic line currents do not contribute to the power in the circuit. On the other hand, the harmonic lamp current will be matched by lamp voltages of the same frequency. The correspondence of phase and magnitude will usually be imperfect but in general there will be some component of power involved.

Practical Significance of Harmonics

One aspect of the practical interest in the study of harmonics lies in the possible effects on public electricity supply systems. From this point of view the disadvantage of low power factor is evident. Nevertheless this does not prove to be a serious difficulty with fluorescent lamps since quite a large percentage of harmonics is required to produce an important reduction of power factor. See Table 1. Probably of more concern are the problems of voltage drop in cables. If the load contains substantial harmonic currents then harmonic voltage drops can give rise to non-sinusoidal terminal voltages, which are obviously undesirable. Another important matter is the presence in three-phase four-wire systems of third harmonic neutral current, which may rise to large values. Major difficulties of this kind have not yet arisen in this country. Their occurrence is made less likely by the careful design of lamp circuits and equipment. For discharge circuits it is recommended that the neutral conductor cross-section shall be not less than that of the phase conductors.

TABLE 1. RELATIONSHIP BETWEEN MAXIMUM POSSIBLE POWER FACTOR AND PERCENTAGE OF CURRENT HARMONICS

Power factor	Total harmonics as percentage of fundamental	Total harmonics as percentage of r.m.s. current
0·95	33·2	31·5
0·90	48·5	43·6
0·85	62·0	52·7
0·80	75·1	60·1
0·75	88·3	66·2
0·70	102·0	71·4

It is assumed that the supply voltage is sinusoidal

From the point of view of the user of fluorescent lamps the factors associated with waveform corroborate the oft-repeated statement that satisfactory lamp performance is quite as much determined by the auxiliary equipment as by the lamp itself. The nature of the lamp current waveform may have a pronounced effect on lamp life. A very peaked current wave is found to reduce life when compared with a wave of the same r.m.s. value but smaller peak, due to the increased positive ion bombardment which provides the additional electron emission required during the high peak of current. Another positive ion bombardment effect is believed to take place when the lamp current wavefront is very steep, although not necessarily reaching high currents. This remains a matter for discussion and further experiment.

These facts emphasise the great importance of the design of the auxiliary equipment. The measures which can be taken to ensure the best waveform operation are rather limited but they should not be neglected.

The simple choke circuit offers little scope for the reduction of harmonics but there are two factors of importance which can be controlled. Firstly the degree of magnetic saturation of the choke has an obvious influence. Secondly the size of the air gap in the magnetic circuit is important. The latter comes about due to the way in which the choke magnetising current consists of the two components, one contributing to the magnetisation of the core, the other to that of the air gap. By suitable design the distorted magnetising wave required for the iron can be partly offset by the undistorted wave required for the air gap.

Another example of the measures which can be taken to avoid unduly large harmonics is offered by the leading branch of the familiar twin tube circuit. In this arrangement the relative values of inductance and capacitance, and the degree of saturation of the iron core can be so chosen to produce an optimum balance between equipment cost and overall performance including waveform characteristics. It will be evident that equipment designed according to these principles may not be the cheapest obtainable, but is essential for satisfactory operation.

The non-sinusoidal currents and voltages involved in discharge lamp circuitry can be regarded as consisting of a number of simply related sinusoidal components suitably superimposed. The presence of these harmonics makes the attainment of unity power factor impracticable, although values very close to unity can be obtained. The harmonic distortion is undesirable from the points of view of the electricity supply authorities and the fluorescent lamp user. Although distortion cannot be eliminated entirely, the correct design of auxiliary gear can avoid excessively bad waveshape.

NOTES ON WIRING by Megohm

Cable Coverings

FROM time to time we read in the national Press that pollution by industry of our rivers is causing the destruction of livestock. Unfortunately one of the penalties of development and the expansion of industry in certain areas is the slow but gradual pollution of our land and waters in this country, notwithstanding the stringent precautions that are taken to prevent such contamination.

Sheath Corrosion

Today it is more than ever necessary that adequate precautions are taken to protect the metal sheathing of underground electric cables laid in the soil, across rivers and the like. Severe chemical and electrolytic action can take place in areas adjoining breweries, farms, docks, marsh land, made-up ground containing cinders and waste matter, agricultural land treated with fertilisers, and where cables are laid in polluted waters. We shall also no doubt have to contend with the effluent from atomic plants, which today is being built in several forms in many places in the country. Pure sea water, however, is not extremely corrosive and good protective armouring and serving on a cable is all that is necessary to ensure satisfactory service.

Corrosion of the lead or lead alloy cable sheath can only take place if the metal is exposed and it is, therefore, essential to make sure that the sheath is well covered by suitable protective materials. In the past where cables were laid in corrosive areas it was the practice to apply in addition to servings two lead sheaths to the cable, the outer sheath protecting the inner sheath and so prolonging the life of the cable. This method of protection, however, is not employed today for obvious reasons—high cost.

Improved protective methods have been adopted by cable makers and the standard materials used for this purpose are paper, cotton and hessian tapes, jute roves, bitumen compound and steel tapes or wires. The method of protecting the cable sheath may be considered in three stages: 1: Bedding; 2: Armouring; 3: Serving.

The first stage is the application of an even layer of compound over the cable sheath followed by at least two layers of compounded paper tapes to bind or hold the compound to the cable sheath. Hessian tapes and/or jute roves are next applied to form a seating and barrier between the compounded tapes and armouring and also to provide a further seating for compound when the armouring is positioned.

The second stage is the armouring which may comprise: a double galvanised wire; or a single galvanised wire; or double steel tapes. Double galvanised wire armouring is only necessary when exceptionally difficult conditions are met and single wire armouring is satisfactory for general use. Steel tape armouring provides good protection against mechanical damage in the longitudinal plane but does not give vertical support to the cables. This form of armouring affords the maximum mechanical protection in the longitudinal plane and is satisfactory for cables laid in the ground, in trenches and in horizontal locations free from vibration.

Serving

The third and last stage for protective covering is the serving over the armouring which comprises hessian tapes and/or jute roves impregnated with compound to provide an outside barrier to the soil or water. Compound used for impregnation of the bedding and serving materials must be free from coal and wood products and of any substance likely to attack the cable sheath, armouring, tapes and serving materials. The compound must also flow and adhere evenly around the cable and when set should not crack or run during transit, installation and operation.

In extremely corrosive ground or water, "Rubber Sandwich" protection has been used for many years. This protective treatment consists of applying rubber tapes interleaved with impregnated cotton tapes with the overall application of compound which vulcanises the rubber tapes, forming a watertight and flexible covering. P.V.C. sheathing is also being used where corrosive conditions prevail but since this is a relatively recent application in this country there appears to be little information available to date, other than the cost, which at the present time is likely to restrict its use.

Electricity for Machine Tools

SPECIAL ELECTRICAL SECTION AT BRUSSELS EXHIBITION

WITH the ever-growing complexity of automatic machine tools, the demands for electrical control equipment has outdistanced the simple straight-on or star-delta switch, and at the third European Machine Tool Exhibition which closed last week in Brussels, a separate section, albeit a small one, had been set aside for electrical exhibits.

For the bulk of the smaller machine tools, electrical gear remains relatively simple. As the machines become larger and more complex it was clear that there remains unresolved the divergence of practice, whether electrical equipment should be in-built or separately housed. When the largest machines are reached, however, space requirements of control gear demand nothing less than a separate cabinet or cubicle. Within these two extremes every type of arrangement was to be seen.

Automatic Control

It is clear that the constant urge towards higher productive levels throughout the world will continue to lead to the development of more complex automatic machines, with a corresponding demand on the control gear designer. One of the machines well illustrative of this trend is the high-speed fully automatic Cawi twist drill grinder. With eight grinding heads this has an output of 1,200 drills per hour. The heads are mounted on a turntable, and the whole sequence of loading, grinding and discharging is carried out automatically by electric control; what is more, the precision of the drill setting within each head is determined by internal electrical contacts. This extensive use of electrical control results in the control gear cabinet occupying much the same space as the actual machine tool itself.

It is significant of this increasing use of electric control gear that Siemens-Schuckert have developed a range of control equipment on the unit principle from which any particular demand from a machine-tool designer can be met from standardised components. The ultimate extension of automatic control to whole machining processes, however, is a view taken by the A.C.E.C. This provides for the work being conveyed in series to a succession of machine heads where individual machining operations are carried out to complete the article by the time it reaches the end of the line. Obviously such combined series machining can make the highest demands on the control-gear designer, particularly when, in addition, control is provided to stop the machine if prescribed tolerances are exceeded.

It would appear that more substantial duties are being demanded of contactor gear, and manufacturers were featuring this with some striking demonstrations. The ability to dismantle from the front appears a universal practice. One of the contactors of special interest is a new A.E.G. design for 10 and 25 amps. This makes use of the good sliding properties of metal on plastic and a special feature is the use of a strip of sponge Buna rubber as a throw-off for the moving contacts. Contactors displayed indicated that this rubber shows no appreciable deterioration after life testing.

Surprisingly, perhaps, there was comparatively little electronic equipment to be seen; one use lay in the control of motor speed, while on a neighbouring stand the same function was performed by magnetic amplifier control.

Vibration-free Motors

The sight of some half a dozen motors, running at full speed yet giving no noise or vibration as a clue that they are in circuit, emphasised the success achieved in designing machines with running qualities that will meet the highest standards required of precision machine tools. Surprisingly, the motors are equipped with ball-bearings, but to a special standard, and are equipped with damping devices. Of the two manufacturers displaying vibrationless motors, one employed a vibration detector which showed on an oscillograph the relative freedom of these motors from vibration, a test which is part of factory routine.

British exhibits in the electrical section were relatively few and mainly confined to specialised instrumentation, a field in which we are building up a substantial reputation.

A.P.L.E. Meets at Liverpool

PRESIDENTIAL ADDRESS HAS "CO-OPERATION" AS ITS THEME

AFTER its Annual General Meeting last Tuesday morning, followed by the induction of Mr. C. C. Smith, A.M.I.E.E. City Lighting Engineer, Liverpool, as its President for the coming year, the Association of Public Lighting Engineers was given a cordial welcome to Liverpool by the city's Lord Mayor, Alderman W. J. Tristram, thus opening this year's Annual Conference and Exhibition of Public Lighting Equipment. Later that day the conference members, comprising over a thousand delegates and members, some from Belgium, France, Holland and Hong Kong, reassembled in the Picton Hall for the President's Address.

In paying tribute to the work of his predecessor, the President referred to Mr. Howard's deep concern for road safety, which subject, although one of several aspects of the work of public lighting engineers, provided a more than sufficient spur to greater effort. Whether this effort be directed to technological improvements or to the solution of administrative or financial problems, the end was an efficient, economic lighting system. In attaining that end, the key to many problems could be found in the word "co-operation."

Well known skyline at Pierhead, Liverpool, shows the Royal Liver Building, the ventilating shaft of the Mersey Tunnel and the Docks and Harbour Board offices. Photo: Liverpool Daily Post

On many occasions in the extensive task of providing public lighting close co-operation becomes essential. Between manufacturers and users of equipment, between Lighting Authorities and Nationalised Boards, and between neighbouring authorities—these are obvious and specific examples of such cases. Broadly speaking, however, all cases may be divided into two classes, administrative and technical.

Administrative Co-operation

Paramount under the category of administrative co-operation comes that between neighbouring local authorities. Lighting schemes, for example, can be dovetailed, with arrangements for common operation and maintenance. One result of local co-operation would be a uniformity of lighting, particularly on main roads although here it becomes necessary to recognise the difference between uniformity of standard and uniformity of type of lighting. Although much has been said about the various types of lighting, the greatest danger is experienced when

passing from a good installation to a poor one, irrespective of type. On long stretches of highway, some variation in the type of lighting is probably desirable.

Important features of this administrative co-operation between Local Authorities are those involving finance. Here, other parties —Lighting Authorities, Ministry of Transport and Nationalised Boards—are introduced. Of the Transport Ministry, it is already widely known that financial assistance from national funds is available for trunk road lighting. Is this adequate? Many feel that it is not, partly as it is available only for first class roads, and partly by virtue of conditions accompanying it. Where such conditions arise out of an understandable desire on the Ministry's part to ensure that money is being spent on a technically sound scheme, would it not be better, with local and national co-operation, for the services of a local expert to be utilised. There is no doubt that grants increased in quantity and scope, and a more trusting attitude toward local authorities would help matters considerably.

Another aspect of administrative co-operation is that between local authorities and nationalised boards, which gives rise to a plea for an early reconsideration of the general policy of these bodies to public lighting. Is it not true that charges for laying mains and supplying energy for these purposes have increased considerably since nationalisation, arising out of changes in policy as well as increases in costs of wages and materials?

Prior to nationalisation public lighting received preferential treatment, mainly because this service was considered a national necessity, and of great importance to the public. Today, it adds an effective and essential contribution to road safety campaigns.

The present-day tendency toward tariff uniformity operates, probably intentionally, to the advantage of the agricultural and rural consumer. Should not public lighting receive similar indirect assistance? Many engineers engaged in this service are convinced that public lighting could be provided more economically by electricity but its cost impedes and delays progress towards this end. Tariff and service line problems are, admittedly complex, whilst Area Boards may not show undue preference to any class of person, but there is a strong case for public lighting.

On a technical level, co-operation is surely required between civil engineer and lighting engineer to implement recommendations made by the D.S.I.R. from results by its Road Research Laboratory.

City centre and suburban lighting in Liverpool. Above: 140 W sodium "cut-off" lighting units in Western Avenue and (left) Mazdalux fluorescent lanterns, using 3. 80 W lamps in Castle Street

J. B. de BOER, Engineer at Philips' Lamp Works, Eindhoven, spoke on

Criteria of Street Lighting Quality

AS the proportion of international traffic on main roads increases, differences in the concept of good street lighting make themselves felt. Thus, in endeavouring to seek agreement on these differing concepts, it becomes necessary to formulate criteria in the quality of street lighting so that fundamental comparisons between each conception are obtained.

In the paper, "Criteria in the quality of street lighting," presented to the Conference on Wednesday morning by Mr. J. B. de Boer (Light Technical Laboratory, Philips', Eindhoven) were set out criteria determining the essential quality of a street lighting installation. Based on work carried out in recent years in both the U.K. and the Netherlands, the paper lays emphasis on the luminance concept and the evaluation of glare.

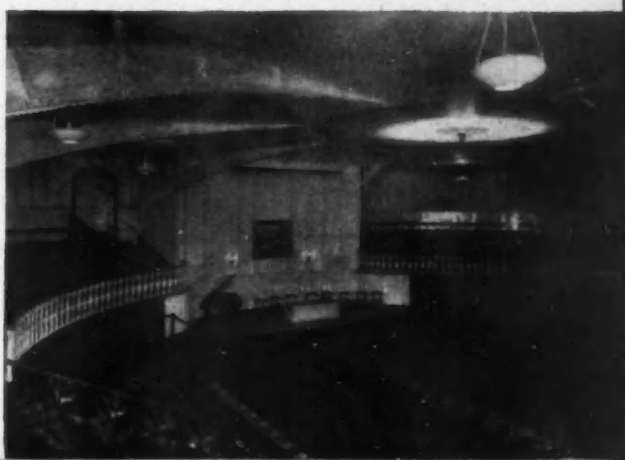
Lighting for Main Traffic Roads

In studying the lighting of a main traffic road (which, to simplify the work, need only be considered) safety is promoted by improved visibility, provided there is no distracting glare, so that the car driver may distinguish other road users, objects, and changes in the road, with greater certainty and from greater distances. The visibility of each detail is improved if its luminance is high, and if there is appreciable contrast in luminance or colour between it and its background. Although the size of each object, and the time available for its observation also play a part, these factors together with that of colour are not so important as luminance and luminance contrasts.

The discrimination between roads for fast traffic and other roads introduces some simplification in the concept of luminance. In the former case, which can be called the long distance interest, objects are seen merely as spots without detail, darker or brighter than their background. Two things only determine their visibility—the luminance of the road against which they are seen and the ratio between their luminance and that of the objects. Although illumination is to a certain extent involved in the visibility of nearby details, it plays no part in visibility at long distances, as then the luminance of the road surface (which is itself, at distances of over 150 ft, viewed at angles less than one degree) depends chiefly upon the directions of light incidence and observation. However, the influence of the angle of observation may be neglected, when considering traffic roads only, enabling the luminance concept to be treated in a manner likely to be acceptable in practice.

Criterion for Glare

The foregoing, which established two criteria for the quality of an installation, makes no mention of glare, which may be considered quite independent of visibility. Although glare might be so acute that contrast sensitivity and other seeing abilities would be impaired, such a degree is well beyond the limits of comfort. Experiments by various workers have shown that contrast sensitivity, at reasonable values of road luminance, and glare are largely independent, whilst glare remains within a given limit. By these considerations is then obtained the third criterion, that glare should remain within comfort limits.



Picton Hall, scene of conference sessions
Photo: Leonard Cord, Liverpool

When considering the luminance of the road surface, from the viewpoint of quantitative data for criteria, it is impossible to establish a definite value for either the level or the luminance uniformity. Work on contrast sensitivity, however, gives some indication in this direction. In this case, experiments in the Netherlands were carried out by stationary observers, carrying out observations on objects, 11 in. square, placed in the field of view along the road at distances of 300 to 700 ft ahead.

Results, given in graphical form, of ratio of road luminance to object luminance plotted to a base of road luminance, show that if the latter falls below a certain value, a considerable increase (more than double) in the luminance ratio becomes necessary to distinguish the object. From the experiments, and others conducted in the laboratory, it seems reasonable to require an average road luminance of 0·15 sq. footcandles (0·5 cd/m^2) to distinguish objects at the smallest luminance ratio.

Data for Luminance Uniformity

Uniformity on a quantitative basis, is more difficult of definition, due to the dependence on shape of any irregularity. Transverse dark strips, seen as narrow horizontal bands, have little effect on visibility but dark patches of vertical shape can be dangerous, as objects disappear against such a background. Along any transverse line therefore, no values smaller than one-tenth of the average luminance could be a reasonable limit, with a further uniformity condition, that the lowest luminance value along that line should be no less than one-third the average for the line. Although such conditions might be satisfied for dry road surfaces, greater variations are likely with wet roads.

Contrasts in luminance to guarantee visibility are more amenable to definition. Results of the work on contrast sensitivity, in which the ratio of the road surface luminance to that of the object seen against it give a measure for the luminance contrast, show the minimum value such contrasts should have. Although the figures evaluated are of the order of 1·5 to 1·7, a value of 2 is to be preferred. This figure is valid only for objects seen in silhouette, a form of vision occurring most frequently on roads at night, and gives convenient figures for street lighting installations. Moreover, as the silhouette basis is used, the ratio for objects seen brighter than their background is 0·5. There is therefore an invisible contrast zone from 0·5 to 2·0, which is to be avoided as far as possible. Special attention should be paid to the smallest contrast which can prevail.

Quantitative Basis for Glare

On the subject of glare, from a quantitative basis, previous work shows that the luminance of the light source has a definite relation with that of the road surface if the glare is not to exceed a certain limit. Moreover glaring effects can be additive which means that the glare experienced in a given installation will not exceed this limit if the actual road surface luminance is greater than the sum of all values individually. When it is considered, however, that in general only fittings of one type will be used, mounted at a fixed height, and only those at distances greater than approximately 100 ft are of interest, it is possible to evaluate glare quite simply. The method uses a relationship between the luminance of the road, the luminous intensity of the source, and the angle, in radian measure, between the directions from the observer towards the glaring source, and the observed point in the road. It provides rapid means to evaluate glare, and, assuming values for the constant and exponents in the term, provides an actual evaluation of the discomfort.

Practical Significance

To obtain an impression of the practical significance of these criteria, they have been applied to three hypothetical installations with fittings having beam distributions of the high angle, medium angle and cut-off types. Assuming a cobble stone road surface, calculations for luminance were carried out for both wet and dry conditions of the road, together with that for the luminance at a height of 1·5 ft on vertical objects parallel to the road.

On a general basis, results show that all three installations are satisfactory for luminance level and uniformity. Contrasts also are sufficiently high except in the case of cut-off lanterns where an object, with a reflection factor of 0·15, may not be seen at every place on the road. On the other hand, the latter fitting is the only type to give comfortable glare conditions. If high-angle and medium-angle distribution can be considered typical of U.K. practice, whilst the cut-off type represents continental European practice, it may be generally concluded that in this country emphasis has been laid on visibility whilst on the Continent, the primary consideration has been the minimisation of glare.

Public Lighting Equipment

SHOWN AT LIVERPOOL DURING THE A.P.L.E. MEETING

This year's exhibition of public lighting equipment, always a popular meeting place for delegates and friends after Conference Sessions, is centred at St. George's Hall, a few yards across the road from the Conference Hall. Officially opened on Tuesday by the Lord Mayor of Liverpool, the exhibition was open yesterday and continues to be today until 6 p.m. when it closes finally.

Apart from exhibits in the Hall itself, there are also the displays of lighting columns and street bollards in St. John's Gardens at the rear of the Hall, whilst in the front on St. George's Plateau can be viewed mobile equipment on show. As a whole, the exhibition offers new developments side by side with well-known equipment, and, as guidance for our readers, the equipment various manufacturers are showing is described below.

Automatic Telephone and Electric Co.

Emphasising the advantage in flexibility of ripple control over the methods of controlling street lighting, the company's "Rythmatic" ripple control system forms the main exhibit. For this method enables lamps to be switched on not only at normal, predetermined lighting up times, but also when climatic conditions deem it necessary. Moreover the system caters for "all night," "half night" and "prior dawn" conditions, whilst the flexibility extends throughout a considerable area.

B.F. and C. Automatic Light Controlling Co.

"Gunfire" time switches are being shown on this company's stand. Together with hand-wound and synchronous models, the electrically wound clockwork motor types are displayed. These have a 24-hour spring reserve and are fitted with solar dials.

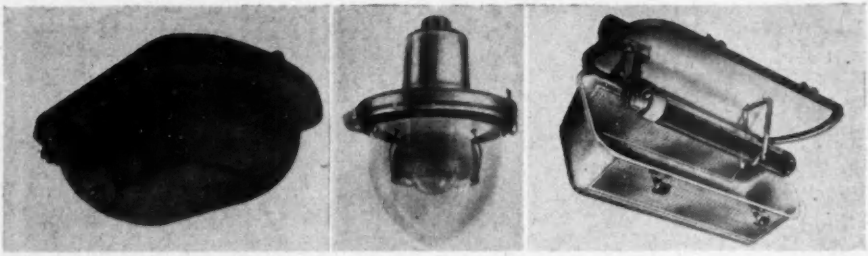
British Thomson-Houston Co.

On the "Mazda" stand, emphasis is placed on improvements in lamp design, although B.T.H. are showing a number of new lanterns. To the former end, however, is the use of new phosphors in type MBF/V mercury discharge lamp. An efficient emitter of red light, the new material is stated to produce light of a colour closely approximating to white light and to render objects in a more nearly natural colour. New 85 and 125W lamps, internally coated with this phosphor, are displayed. Further design improvements are evidenced on the stand in types MA/U and MA/V mercury vapour lamps.

Concrete Utilities

In the outside exhibit of lighting columns, we understand that this company displays a variety of reinforced concrete columns for both Group A and B lighting. Of the former there is the "Avenue 3D" type, having 5 ft. Arc 2 brackets. In St. George's Hall, their stand is devoted to pictorial illustrations of recent installations.

In the heading illustration is seen Stanton's Type 8F column (left) for main road lighting, Siemen's "City" lantern as installed in King Street, London, and, right, the "SS Fifty-one" lantern by Metrovick



From left to right, the Mazda "Sapphire" reflector fitting for mercury lamps, the new tungsten lamp fitting introduced by the G.E.C., and Falk's S93821 "Fulmar" V lantern for side entry

Costain Concrete Co.

Prestressed concrete lighting columns, we understand, are featured in this company's exhibit in St. John's Gardens. Columns for both groups of lighting may be seen. In precast concrete models there is a 15 ft mounting height column for which the brackets are either 18 in. in outreach or a specially introduced "C" design.

Crompton Parkinson

As last year Crompton's introduced the "Concept," so this year the company is introducing the "Concept 2," designed to improve the composition of both lantern and column and to minimise maintenance. Using concrete for the supporting arm, a smooth Perspex bowl, and a small amount of metal work almost entirely non-ferrous in character, maintenance, it is claimed, has been reduced to re-lamping and occasional wiping of the bowl. Also on view is a development of the "Corona II" lantern for 140W sodium vapour lamp in which all auxiliary gear is incorporated within the hood.

Edison Swan Electric Co.

Two new lanterns feature on the "Ediswan" stand of which the fluorescent fitting should prove most popular. In contemporary style, the silhouette presented by brackets and lantern forms an unbroken line to give the unit a pleasing appearance. In the lantern, control gear and lamps are mounted on the reflector only, so that for maintenance the entire reflector unit may be removed without disturbing the lantern. The second new lantern is their "BT.22," a top entry unit for side road lighting.

Electrical Development Association

Better street lighting for increased road safety provides the theme for E.D.A.'s stand, which shows photographs of modern electrical installations supported by charts, diagrams and other data. Emphasis is given to methods of lighting streets in city centres where lack of space precludes the use of columns. Moreover a model of a typical installation accompanied by other information illustrates a new method of mounting lamps at road junctions.

Engineering and Lighting Equipment Co.

Exhibited on this stand is a full range of fittings for all types of lamps, indicating improvements at reducing maintenance costs. Lanterns incorporating such developments—the "Welwyn" and "Ware" fittings being notable examples—may also be seen. Another lantern being shown is the "Universal 100," which is available in both open and closed versions. Its prisms are machined on the inside of the Perspex cylinder, claimed to be a unique feature, whilst in the latter model there is no deterioration due to weather conditions.

Falk, Stadelmann

Two further lamps have been added to this company's "Fulmar" series for horizontally burning sodium vapour lamps. Made in two versions, for top or side entry, both lanterns are of the enclosed type in contrast to others in the series. Its Perspex bowl, slightly "stippled" to improve daylight appearance, encloses two refractor plates, having machined faces and hermetically sealed, to effect a high efficiency light distribution coming within the medium beam angle category. Its stainless steel clips are designed to operate using one hand only.

Ford Motor Co.

Amongst the mobile equipment being displayed by this company is to be seen their three-stage tower wagon. Mounted on a "Thames" two-ton chassis of 128 in. wheelbase is the Eagle Engineering Co.'s elevating tower with hydraulic lifting gear, complete with oil pumps, power take-off and having a maximum platform height of 25 ft.

Franco Traffic Signs Ltd.

Making their debut at this stand are two exhibits—a new bollard and external lighting fitting. With the former, a "streamlined" effect has been obtained, even the tamper-proof reflex lenses being incorporated as an integral part of the unit. Maintenance is effected through a door at the rear. In the lighting fitting, a development of the "Super Exlite," vertically mounted lamps are used, aimed at ensuring adequate support for the filaments.

General Electric Co.

Of new lanterns being displayed by the G.E.C. is one designed for main road lighting, housing a 300/500 W tungsten filament or 250/400 W mercury lamp. Suitable for top or side entry, the lantern body is constructed from cast iron and is of simple design, and two forms of optical control are available, depending on the lamp to be used. For tungsten lamps, light control is effected by a single-piece prismatic glass dome refractor enclosed in a clear or dimpled glass bowl. In the mercury lamp form however, use is made of an outer single-piece prismatic glass refractor. In fluorescent fittings is seen a new lantern, believed to be the first available, housing five 67·5 W hairpin-shaped cold cathode lamps.

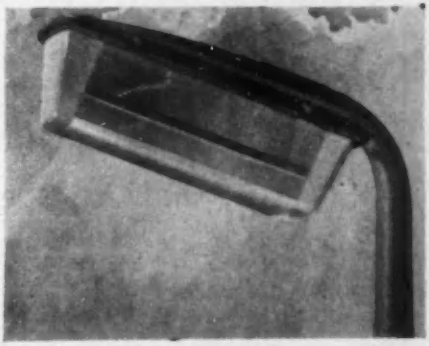
John Gibson and Son Ltd.

Among the range of mobile tower ladders, this company is showing in the outdoor section, is to be seen an electrically propelled model, incorporating a Graisley power unit to drive the tower at walking speed.

Gowshall Ltd.

Illuminated guardposts, and new "Signlite" fittings for externally illuminating all traffic signs form a prominent part in this company's stand and outdoor exhibit. Also being shown are cast iron island sites designed for rapid erection yet requiring no more attention, it is claimed, than occasional painting. A recent addition to their guard posts includes the "Sheerline," in which

Bedford-Eagle tower wagon type "F" which is exhibited by Vauxhall Motors



The contemporary design of Ediswan's new fluorescent lantern for 2 ft. lamps is well shown here

all protrusions have been avoided to give an attractive streamlined finish.

W. T. Henley's

Cables take pride of place on Henley's stand, samples of rubber and p.v.c., insulated cables and flexible cords, metallic flexible armoured cables and cords, low voltage p.i.l.c. cables, and aluminium sheathed cables being shown together with examples of tapes and compounds. A comprehensive range of electrical distribution equipment may also be seen.

Holophane Ltd.

Two post-top fittings are found among the representative range of lighting fittings displayed by this company. Designed for use with tungsten filament g.l.s. lamps and sodium SO/H discharge lamps respectively, the units give a two-way non-aerial light distribution suitable for Group B lighting. For Group A is the sodium cylindrical refractor lantern embodying adjustment of the cylinder to ensure the correct angle of incidence of main light beams on non-horizontal road surfaces. Stated to be adjustable for gradients up to one in five, this lantern is aimed at maintaining uniformity of road brightness whilst avoiding glare.

Horstmann Gear Co.

Displayed on this stand is the company's Type "Y" time switch claimed to be the smallest of its type available. Designed to meet a demand for compact units for use where space is limited this switch is of the electrically wound type, having a 12-hour spring reserve, of the plug-in variety, the time switch is constructed to permit switch and clock movement to be removed without disturbing the existing wiring. Among the other electric time switches and controllers being shown is a new flasher unit for illuminated road crossing beacons.

Imperial Chemical Industries

Here can be seen displayed two products of the I.C.I. plastics division—"Perspex" acrylic

sheet and "Dorvic" rigid p.v.c.—both of which have found extensive use in public lighting equipment. Moreover, photographs and display items, in addition to standard and prototype fittings, illustrate the organisation's technical service freely offered to lighting engineers concerned with the development of applications of these materials.

John Kerr and Co. (Manchester)

A range of aluminium alloy ladders are being shown by the company in the mobile equipment section. On view are tower ladders, extension ladders, pole ladders and standard ladders, all constructed from a double heat treated alloy. Pawls are fitted on all extension types to effect control of working height, whilst corrugated anti-slip rungs are fitted universally.

R. A. Lister and Co.

Exhibited in the outdoor stand is this company's "Eclipse" portable telescopic tower ladder. Mounted on a Lister "Auto-Truck," the tower ladder is now extended by means of an engine driven pump. Fully extended, its platform height above ground level is 24 ft 6 in., whilst closed to clearance is a little over 11 ft. Its rotating platform, 4 ft by 2 ft is stated to be adequate for two men to work from it at the same time.

Mersey Cable Co.

General applications of rubber and thermoplastic insulated wires, cables and flexibles can be seen, the emphasis naturally being on their use for street lighting.

Metropolitan-Vickers Electrical Co.

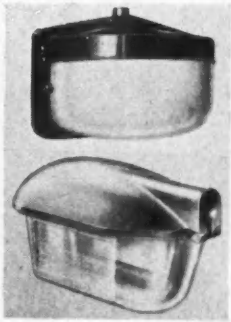
Although not exhibiting at St. Georges Hotel, this company has available for inspection at the nearby Adelphi Hotel a representative range of its equipment. Among lanterns on show is the "SO Fifty," a recent addition, which utilises 85 W or 140W sodium lamps for main road lighting. Provision is made for ancillary gear to be fitted in the lantern of value for installations where shortage of permanent space necessitates using a column of the smallest possible cross section. Another recent development is a top entry version of the "Trafford II" lantern.

Philips Electrical Ltd.

Philips' stand is largely devoted to sodium lamps, in whose development this company played a large part. One of the features is the manner in which the efficiency of these lamps is demonstrated whilst two new developments are displayed for the first time. New versions of MBF/V lamps, providing better colour rendering, are also to be seen.

Poles Ltd.

A selection from the company's range of "Adastra" columns is displayed in the outdoor exhibit, models in both hexagonal and circular form in 15 ft and 25 ft mounting height, being available for inspection. All such columns, built-up from tapering tubular steel sections, are designed to assist transport to the site. Sections rest inside each other so that they are all contained in the largest which is normally from six to seven feet in length. New to the range is a narrow base column, double tapering, of circular section for 15 ft mounting height.



Above, left, is shown Poles' "Adastra" circular column with the "Pimlico" arm, whilst on the right are seen, above, the Revo "Critchley" wall mounting lantern and, below, Wardle Engineering's "Stuart" fitting

Revo Electric Co.

Fittings for use with tungsten, sodium, mercury and fluorescent lamps make an extensive selection to represent this company's street lighting equipment. For wall mounting on side roads is the "Critchley" lantern, comprising cast iron body and frame, vitreous enamelled internal reflector and opalescent Perspex bowl, utilising two 60W or 75W filament lamps. A fitting in aluminium alloy with sheet steel vitreous enamelled inner reflector (C12423/AL) is fitted with the company's "Kleen-prism" refractor and is suitable for tungsten, mercury and fluorescent lamps.

Sangamo Weston

Type "SS" time switches form a major part of the company's exhibit, the model "SSC" with

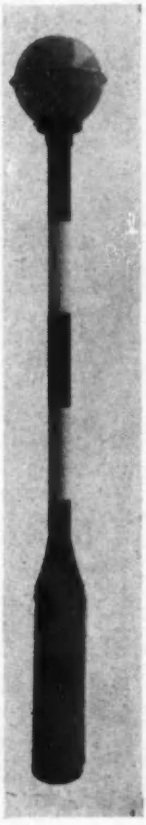
solar dial being among those shown. Also to be seen is a representative selection of the company's electrical measuring instruments, covering all requirements from laboratory standards to miniature panel models and photo-electric exposure meters. To complete the display is a range of a.c. watt-hour meters and accessories.

Shaftesbury Ladders Ltd.

In the mobile equipment section, we understand this company to be showing its trailer tower unit "TT/3R." A three-section tower ladder, its revolving platform is 4 ft 6 in. long, and locks in all positions. Elevation is effected by an hydraulic system and the unit may be towed or manually propelled.

Siemens Electric Lamps and Supplies

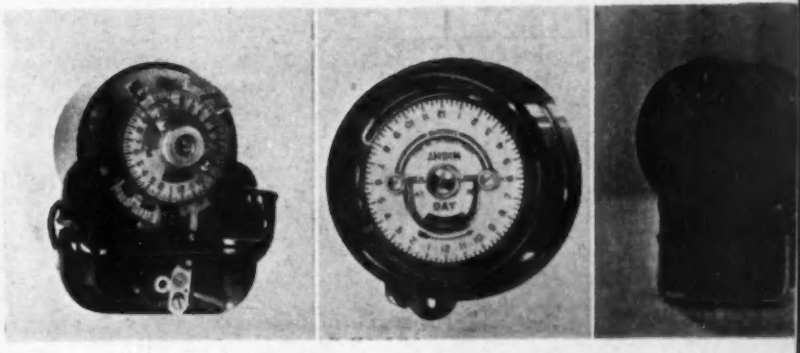
To meet the requirements of city centre lighting where pavement space is limited the Siemens "City" lantern is being shown. Recently developed and installed in the City of London as part of their coronation programme, it is novel in that it is a vertically wall-mounted fluorescent unit having a prismatic optical system, and utilising three 80 W tubes.



Stanton Iron Works

Both types of column—for Group A and Group B lighting—can be seen displayed by Stanton in the outdoor exhibit. In the former category are their 8D, 8E, 8F and 8L columns, the first and third being of the single bracket types, the others twin-bracket columns.

Gowshall are showing this flashing beacon (left) with its large base column, whilst below from left to right are shown Venner's Type MSDC and the Sangamo Weston Type SSC time switches with the Horstmann "flasher" unit for crossing beacons



Stewarts and Lloyds

Standard tubular steel columns being shown by this company include eight columns for Group A lighting and four suitable for Group B, having 13 ft and 15 ft mounting heights. Designed to take up the minimum of footpath space, they are shown here without any form of ornamentation, although such embellishments can be supplied if required.

Thorn Electrical Industries

One of several new fluorescent fittings being shown on this stand is the "Atlas P.51." A vertical fitting, it can be supplied for either two 5 ft 80W or 4 ft 40W lamps, and has a reeded Perspex diffuser. Light distribution is through an angle of 240° in the horizontal plane, whilst average output, using 5 ft Atlas "white (3500°K)" lamps, is stated to be 8,000 lumens.

Vauxhall Motors Ltd.

Two types of tower wagon are to be seen in this company's outdoor display. One has a truck-type body built by Lee Motors, mounted on a three-ton, long-wheelbase Bedford chassis, and its tower is detachable. The other, built on a three-ton, short-wheelbase chassis is the standard Bedford Eagle tower wagon type F.

Venner Ltd.

On this stand may be seen the small synchronous motor-driven, solar dial, double circuit time switch, type MSDC, particularly suitable for fluorescent lighting installations. It can be set to switch on all tubes in each lantern at sunset, switching off a portion at midnight and the remainder at dawn. Similar control for columns having mains and subsidiary lighting may also be effected.

Wardle Engineering Co.

Sodium lighting is emphasised on this company's stand, two lanterns in particular for this purpose being the "Atholl" and "Stuart" fittings. Both totally enclosed, the former utilises 85/140W lamps and the latter 40/60W lamps. For measuring discharge lighting there is the "Melville" lantern whilst the "Ashley" fitting may be used with 100 or 200W g.l.s. lamps for side roads.

PROBLEMS AND PRACTICE in Engineering

Trouble in the Shunt

A LINE of 20 h.p. d.c. level compounded motors is employed to drive a paper making machine. Recently one of the motors developed a fault, taking a heavy current yet standing still on no-load.

The shunt winding of each motor is controlled by an automatic regulator of the face-plate type. The position of the arm of the regulator is controlled from one side through a belt drive from the motor it regulates and from the other side by a 3-phase motor supplied by a 3-phase alternator directly coupled to an independent d.c. motor. Both drives are coupled through a differential gear, allowing the arm to take up any position determined by the motor speed on the plate.

The motor in question was driving paper at 150 ft/min when it suddenly stopped. On investigation I found the shunt field contactor and main contactor still in and the ammeter in the armature circuit showing 60 A. On removing the coupling to the paper machine, attempt was made to start the motor again. This time, however, the armature current was the normal 30 A, on the "crawl" position, then increasing violently and bringing out the contactor on pressing the "run" button.

Further investigation, by moving the face-plate regulator by hand round to the all out position, caused the motor to start. This gave the clue to the fault, which was found to be an open circuit on the face-plate regulator, open-circuiting the shunt field. On repairing the break the motor ran up to speed quite normally.

The currents shown on the ammeter gave some cause for thought when trying to determine what was happening. There are two stages in starting, the first initiated by pressing the "crawl" button. This energises the shunt field contactor coil, closing the shunt field circuit, and also connects the armature, series field winding and interpoles in the supply in series with a rheostat. This resistance restricts the armature current to 30 A, so that the series and interpole windings are partially energised whilst the shunt winding is fully energised, thus ensuring that the motor does not start in reverse.

On pressing the "run" button, the rheostat is taken slowly out of the armature circuit, and the motor runs up to speed. The "run" contactor then operates, by passing the "crawl" contactor, rheostat, and overload coil together with the three-phase contactor starting up the motor controlling the other side of the field regulator. The arm then takes up its position for the speed at which the motor is set.

Under the fault conditions, the motor failed to crawl during the first stage and on pressing the button, the current (at the second attempt it will be remembered) rose to an alarming value and finally operated the "crawl" overload trip.

However, one would have thought the motor would start, in reverse, on its series windings, but a little thinking convinced me this was impossible. The interpole flux would have been opposing the series flux, already weakened by armature reaction (also in the reverse direction) so that the resultant flux would be insufficient to provide the necessary starting torque.

Under the fault conditions pressing the "run" button, and consequently taking the rheostat out of the circuit would naturally be followed by a current sufficiently high (due to the absence of a back e.m.f.) to operate the overload trip. Yet when the fault was first reported, only 60 A was being registered on the ammeter, the reason for which still escapes me. The overload trip was set to operate at 85 A. Since the first fault was repaired, several other regulators have given the same trouble, and have been rectified in the same way.—*D. F. W.*

Contributions to this page dealing with specific items of interest to electrical engineers and maintenance men are welcome, and, if accepted, will be paid for at our standard rates. Problems of a practical nature to which a solution is required will also be considered. Contributions should be written on one side of the paper only and may be accompanied by sketches, which will be re-drawn for publication.

Universal Differential Analyser

New Machine speeds solution of Control and Servo-mechanism Stability Problems

DEVELOPED to give rapid solutions to problems of aircraft design, an electronic analogue computer being manufactured by Short Bros. and Harland Ltd. should prove to have applications in a far wider field of engineering. With this in mind, it has been designed to facilitate eventual quantity production. As a result, it should be considerably lower in price than the several special purpose instruments which have been developed from time to time for a limited range of problems.

Essentially the computer is of the differential analyser type, in which a differential equation is set up on the machine, and the solution obtained as the variation with time of the dependent variable when some disturbance is applied to the system capacity.

The computer is built to be capable of the solution of three simultaneous linear second order differential equations. To provide facilities for the solution of more complex problems, arrangements are provided for linking two or more computers together. Only three types of computing element are needed: those performing the operations of integration, of addition, and of adjustment of scale. Scaling units are essentially three-decade variable resistances. In combination with high-gain five-valve amplifiers and resistance-capacitance networks known as function units, these scaling units perform addition, integration and other linear operations.

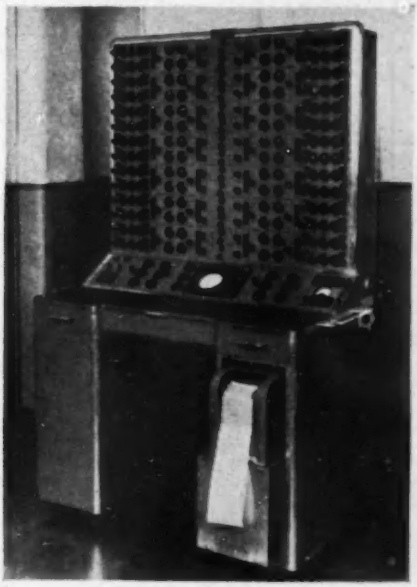
To provide the right capacity with a reserve, and to meet a further requirement that three computers linked together should be capable of tackling a general six-degrees-of-freedom problem, each computer will have eighteen amplifiers and a corresponding number of function and scaling units.

Two methods of working are possible. The first is to choose a slow time scale, of the order of seconds, and to initiate the required disturbance (usually a voltage step) manually. A pen-recorder can then be set up to give a record of the system's reaction. An alternative method is to operate repetitively, usually with a fast time scale, reducing the time constants of the system if necessary, and to observe the solution with a c.r.o. Facilities are provided for both methods, and a time marker is provided for the c.r.o. trace.

When the c.r.o. is used, each cycle of operation is divided into two parts. The first half is the visible sweep, after which the spot is suppressed, a system of relays restores each amplifier to its quiescent condition, and any drift of the d.c. amplifiers is automatically corrected.

Each computer stands only 5 ft 9 in. × 3 ft 6 in. × 2 ft 2 in. deep. It can be set up without electrical knowledge by anyone fully capable of formulating the equations which have to be solved. Setting up the computer is mainly a matter of adjusting the scaling unit dials and plugging-in links on a neat connection board which avoids the use of cords. At present, the computer will only deal with linear systems which are initially in a quiescent condition, but additional computing elements now under development should remove these restrictions.

The prototype differential analyser



Encouraging High Load Factor

LOWER charges for high load factor use of industrial supplies, are announced by the South West Scotland Electricity Board, along with several other amendments to the industrial and commercial m.d. tariffs. Among these is the introduction of a more realistic basic fuel price in the existing tariffs which incorporate a fuel clause. From October 1, the fuel price will be 60/- per ton instead of the present 38/-. Consequential adjustments thus require to be made in the unit rates, and these now become 0·661d. per unit (formerly 0·45d.) for a high voltage supply, and 0·686d. (previously 0·475d.) for a medium voltage supply.

In the case of h.v. consumers, the coal variant has been reduced from 0·0008d. to 0·00075d. p.u., and at the current estimated fuel cost of 71/9d. per ton will have the effect of lowering the price to these consumers.

At present the standard industrial and commercial maximum demand tariff contain a fixed unit charge which applies no matter the load factor at which the consumer uses his supply. To encourage consumers to improve their load factor the Board has introduced a step-down rate where the load factor is more than 50%. In such cases the step-down rate will be 0·636d. for h.v. supplies and 0·661d. per medium voltage supplies, and will apply in respect of all units in excess of 365 per kW of m.d. in each month.

A change is also announced in the definition of h.v. and medium voltage supplies, as a result of the standardisation of voltages. Henceforth a high voltage supply will be at more than 650V, and a medium voltage supply at 650V or less. Stressing that the price reductions have not been granted because of surplus revenue in their hands, the Board state that additional revenue is required. But it is preferred to obtain that additional revenue from expansion of business rather than by increasing charges. A greater use of electricity at times when an abundant supply is available, is the Board's aim. With this in view, cheap rates for restricted hour and off-peak supplies have already been introduced. The Board has about 7,000 industrial and 70,000 commercial consumers.

Supply in Great Britain

FIGURES relating to electricity supply in Great Britain, including the non-nationalised concerns, are included in the latest report to be published on the Census of Production for 1950. Nine "larger" non-nationalised undertakings in England and two in Scotland are included. A larger undertaking in this context is one employing more than ten persons. There were two undertakings employing less than ten persons in England, and two in Scotland.

Total employment during the year was 176,922, and there were 362 generating stations. Net output per person employed was £926 for England, £917 for Wales and £1,081 for Scotland.

ANALYSIS OF SALES FOR LARGER UNDERTAKINGS

	Value of sales £'000	%
Bulk supplies by non-nationalised industries to other undertakings	438	0·2
Supplies to: Domestic consumers	81,359	35·0
Farms and horticultural premises	2,586	1·1
Public lighting authorities	2,127	0·9
Traction undertakings—railways	7,134	3·1
—tramways and trolley buses	4,342	1·9
Shops, commercial premises, etc.—shops	18,269	7·9
—offices	6,353	2·7
—public buildings, schools, places of entertainment, etc.	9,727	4·2
—hotels	2,208	1·0
—H.M. forces	2,081	0·9
—other premises	4,146	1·8
Waterworks, gasworks, drainage, etc.	2,887	1·2
Factories, workshops and other industrial premises (up to 650 V)	35,327	15·2
(above 650 V)	53,097	22·9
TOTAL SUPPLIES TO CONSUMERS	231,641	99·8
TOTAL SALES	232,079	100·0

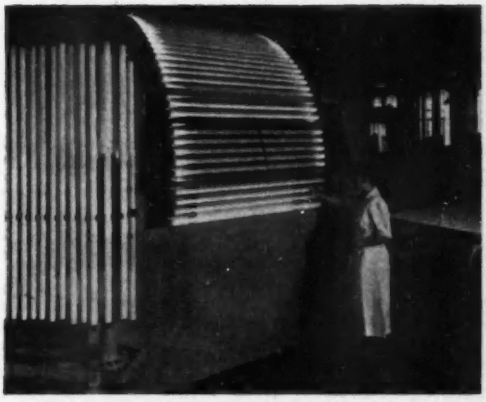
Ensuring Efficient Tubes

Developments in Research at G.E.C. Laboratories keep in touch with Production Techniques

THE value, in a large industrial organisation, of a central research organisation is to be seen in several ways. Apart from this type of organisation lending itself to straightforward policy control, there is the additional advantage that the central organisation can employ, and keep fully active, specialised staff. A departmental research group would at times find it difficult to supply a specialised engineer with sufficient work. On the other hand, the research organisation must keep in close touch with the production department which it serves, to ensure that all developments may be modified for acceptance on a production basis.

One example of this type of co-ordination and deployment was seen last week at the G.E.C. Research Laboratories at Wembley. Here, opportunity was taken to inspect and discuss work in connection with recent improvements to "Osram" hot-cathode fluorescent tubes, and the methods by which such improvements were adapted for full-scale production.

From the research aspect, the three main contributions to the improvements were in the fields of the fluorescent powder composition and structure, deposition of the powder on the tube, and cathode design. Such work, when it is considered that the practical limit of efficiency of this type of lamp is probably not far from attainment, necessitates the use of such equipment as a high voltage X-ray unit, the electron microscope and



At the top of the page an assistant in the G.E.C. Research Laboratories operates a Physical Eye Photometer and Colorimeter, in conjunction with a 12 ft integrating sphere to measure total light output and spectral composition of lamps. Bottom left shows an automatic stabilising machine, with tubes being delivered by the conveyor on the left and stabilised tubes removed on the right. Bottom right depicts one of the quality control checks during production, tubes' electrical characteristics being measured

electron diffraction apparatus.

In the first field, that of fluorescent powder composition and structure, it will be remembered that the laboratory, in 1946, developed the halophosphate group of fluorescent materials which gave a performance considerably improved over that of previous forms of powder. To ensure, however, that these materials operate at a high efficiency, both their structure and purity must be closely controlled. Particle size should not be identical, but must vary within close limits, whilst traces of impurity of the order of a few parts in one million can markedly impair the performance of the powder. For the accurate measurement of colours and their proportion in the light emitted by fluorescent powders, an instrument was specially developed by the laboratories for internal use. Such, however, is its value that others had to be made to satisfy demands from outside the G.E.C. organisation.

Depositing the coating inside the lamp is effected by forcing the material (in suspension in a suitable "binder") hydraulically into the vertically mounted tube, from which draining by gravity enables an even coating to be obtained. The cellulose binding material is dispersed by heat during baking, leaving the powder adhering to the glass.

Cathode Assembly

Although the fluorescent material plays one of the most important parts in the operation of the lamp, considerable attention has been given to the cathode assembly to ensure high reliability. Superficially it is a coiled-coil tungsten filament coated with a thermionically emissive compound. In practice considerable attention is necessary to obtain the correct geometrical shape and dimension whilst the coating, whose chemical and physical conditions require close control, has to be applied evenly without clogging the main spiral.

From the production viewpoint, the assembly and coating are conducted at the G.E.C. works at Shaw, Manchester, in one machine. From the coiling machines, the tungsten filaments are fed to a multi-lead assembling machine, which fixes them to the nickel lead-in wires. They are then coated automatically by being immersed in a bath of the material. Temperature control within limits of 1°C, checks on fluidity, combined with careful timing, enable the coating to be applied correct to within 0·00004 oz. Such methods, minimising the ingress of impurities, are claimed to have eliminated the tendency to blackening at the tube ends.

New Pumping Technique

A further research development successfully applied at Shaw is a new vacuum pumping technique. During evacuation of the tubes, care must be taken to ensure that all carbon gases held in the components are removed apart from the air itself. The machine uses a technique known as "mercury dosing," in which a small amount of mercury is introduced into the tube at a given stage during the initial pumping, and then again during the "de-gassing" period. Not only is pumping time reduced, but the method ensures a high vacuum and liberation of the carbon gases.

New automatic stabilising machines to produce the correct condition of cathode activation have also been installed. Designed to stabilise the striking voltage, and hence to reduce variations in the performance of successive lamps, the machine is fitted with a complex system of voltage regulating equipment. Statistical methods of quality control are also used by the company to minimise imperfection in production processes. Testing and measurement of tubes selected at random at stages during production, includes X-ray analysis of phosphor before mixing, photomicrographs of phosphor particles and measurement, by a "reflectometer," of the thickness of the fluorescent coating.

Colour Rendering

One of the more important investigations also being conducted currently at the Research Laboratories is that of colour rendering. Although the colour of the lamp and its colour rendering properties are extremely elastic, any improvements in this direction usually result in a fall in the lamp efficiency. The highest efficiencies, in value over 50 lumens/watt, are given by both "warm white" and "daylight" lamps. "Natural" lamps, whose colour is an improvement on "daylight" have, however, an efficiency of 47 lumens/watt, "whilst with colour matching" and "mellow" lamps—the latter being popular for social occasions—efficiencies below 40 lumens/watt are usual.

None of these lamps however lends itself for use with tungsten lighting, an effect which was strikingly demonstrated during the visit. Present work is directed to finding a solution to this problem, a prototype lamp recently developed showing promising results at a comparable efficiency.

Two-Wire Distributors

The Use of Mechanical Analogies can assist National Certificate Students

By J. E. MACFARLANE, B.Sc.(Eng.), M.I.E.E.

CALCULATIONS of current distribution and voltage-drop in two-wire distributors supplying various loads can be carried out using Kirchhoff's Laws or by Maxwell's Circulating Current Method.

Whilst these methods are accepted by students familiar with distribution in their everyday work they may cause difficulty to some in other branches of industry. With the growing use of electricity in mechanical engineering, more mechanical engineers need a working knowledge of distribution, and this is also the case with marine engineers studying for Ministry of Transport examinations.

Elementary distribution is dealt with during the S3 year and the Ordinary National Certificate examinations may contain simple questions on distribution. The majority of S3 students have taken Mechanical Engineering Science (S2) in the previous year, so that it is not a bad policy to make use of some of the principles of this subject in the following year. Furthermore it helps to dispel the practice of keeping different subjects in "watertight compartments," even when there is a family resemblance in the method of attack.

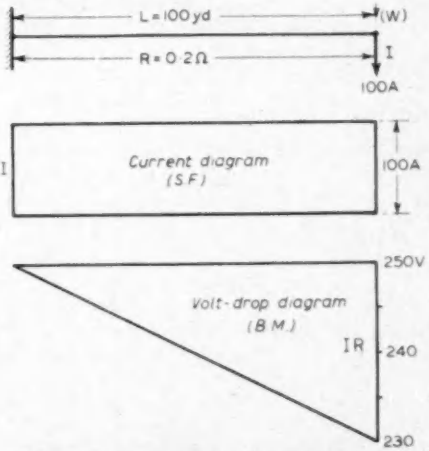


Fig. 1.—Dead-end distributor and diagrams

It is as well to start in an elementary way and some simple examples, which are almost self-explanatory, show the similarity between current load diagrams and shear force diagrams, also volt-drop diagrams and bending moment diagrams.

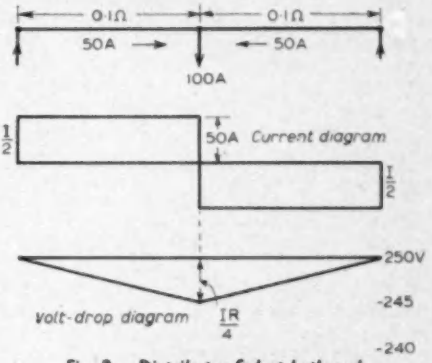


Fig. 2.—Distributor fed at both ends

Consider a distributor 100 yd long (L) with a resistance of 0·2 ohm (R) for both conductors of the cable, with a total load of 100 amps (I) at the far end. The voltage at the feeding point is 250. It is a good exercise for the student to draw these diagrams to scale and to use a single-line diagram for the two-core cable.

(1) *Distributor fed at one end, or a dead-end distributor.* The distributor, current diagram and volt-drop diagram are shown below one another in Fig. 1 and the scales of the various quantities are evident. The current diagram is the simplest shear force diagram and the volt-drop diagram is the same shape as the bending moment diagram of a cantilever loaded at one end, but turned end for end. The voltage drop is indicated on the lowest diagram below the horizontal for 250 V at the feeding point. The maximum voltage drop is IR which is compared with the maximum bending moment of WL. The volt drop to the load is $IR = 100 \times 0{\cdot}2 = 20$ V, so the p.d. at the load is $250 - 20 = 230$ V.

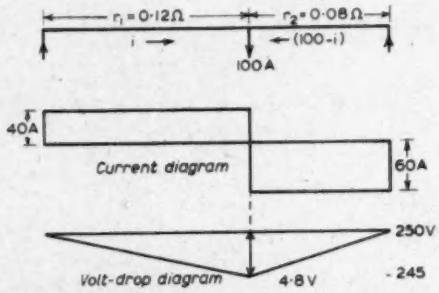


Fig. 3.—Distributors fed at each end but load not in centre

(2) *Distributor fed at both ends at the same voltage.* This is the same as a ring-main, when shown as a developed diagram. The values are as before and the load occurs at the centre. By symmetry 50 amp is fed to the load from each end. The three diagrams are shown in Fig. 2.

The volt-drop to the load is $\frac{IR}{4}=5$ V, which is one-quarter of the first case. The p.d. at the load is $250-5=245$ V.

(3) *Distributor fed at each end, or a ring-main, but load not at centre.* The load is 60 yd from the left-hand end, as shown in Fig. 3. Let the current from the left-hand end be i amp then from the right-hand end it is $(100-i)$ amp. As the voltage at each end is the same, equating voltage drops to the load we obtain $i=40$ amp, $ir,=4{\cdot}8$ V, hence the p.d. at the load is $250-4{\cdot}8=245{\cdot}2$ V. As a check, from the right-hand end the current in a negative mathematical direction, as shown by the current diagram, is $100-40=60$ amps, and the drop to the load is $60\times0{\cdot}08=4{\cdot}8$ V as before.

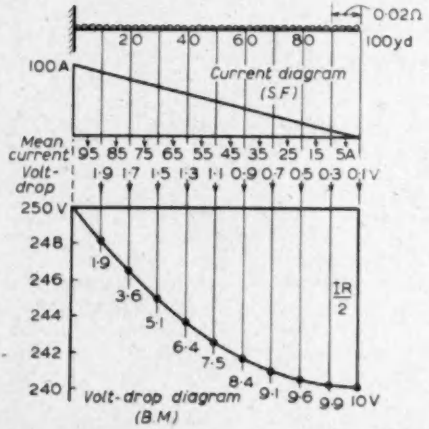
The maximum voltage-drop is $\frac{Ir_1r_2}{R}=4{\cdot}8$ V which is a similar calculation to that for the maximum bending moment.

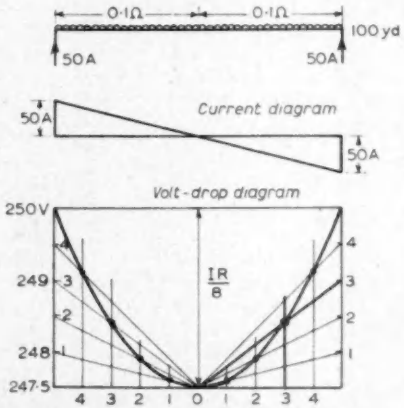
With a single load in various positions, the maximum volt-drop occurs when the load is at the centre, which can be shown by a simple differentiation equated to zero.

(4) *Uniformly loaded distributor fed at one end.* When a distributor is laid down a road supplying a number of premises the load can be considered as uniformly distributed at so many amperes per yard.

If a short length is considered, say 10 yd, which is about the frontage of a house, then the load can be considered as concentrated at the centre of this arbitrary length. With a distributor fed only at one end the current will grow uniformly from zero at the far end to the total current from the feeder and the voltage-drop diagram will be parabolic. If the same distributor as before is fed at one end at 250 V and the load is uniformly distributed at 1 amp/yd, the current and volt-drop diagrams are given in Fig. 4. The total resistance of 10 yd is 0·02 ohm and the current at the end of each length increases by 10 amps. The current diagram is triangular, the mean current for each section being shown together with the volt-drop per section. The volt-drop diagram is constructed below and subtracting the volt-drops from the supply voltage of 250 gives a parabola.

The maximum volt-drop is $\frac{IR}{2}=10$ V





On the left is Fig. 4, which is drawn for a uniformly loaded distributor fed at one end. Fig. 5 (right) is drawn for a similar distributor fed at each end at the same voltage, or for a ring main

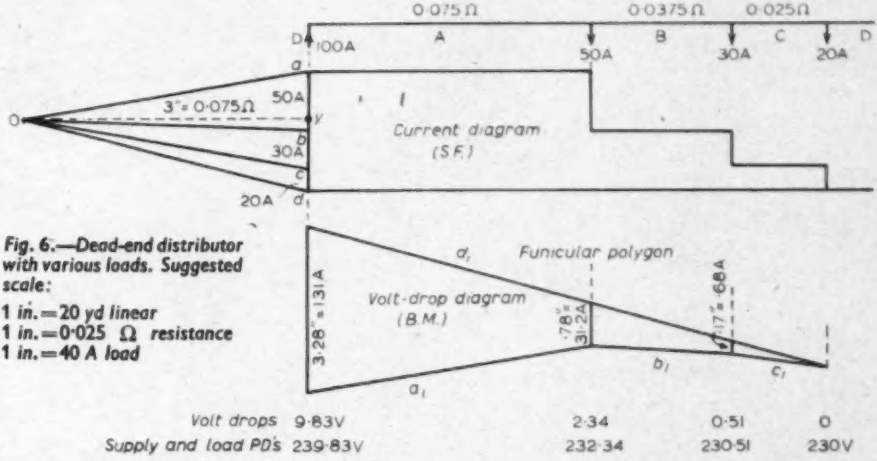


Fig. 6.—Dead-end distributor with various loads. Suggested scale:
1 in. = 20 yd linear
1 in. = 0·025 Ω resistance
1 in. = 40 A load

which is half that for a concentrated load at the end of the distributor.

At this point it is useful to consider the power losses in cases (1) and (4) as their ratios are not the same as the voltage drops. Consider each 10 yd length in Fig. 4, then the I^2R loss is 0·02 (sum of squares of current) = 0·02 × 33,250 = 665 W compared with that for concentrated load = $100^2 \times 0{\cdot}2 = 2{,}000$ W which is *three* times as great.

(5) *Uniformly loaded distributor fed at each end, or a ring-main.* By symmetry the maximum voltage drop will occur at the centre and the current fed in at each end will be $\frac{I}{2}$ as shown in Fig. 5. This can be considered as two uniformly loaded distributors fed at one end with *half* the total current and of *half* the total resistance, butted together. From the previous example the maximum volt-drop for each half is $\frac{1}{2} \cdot \frac{I}{2} \cdot \frac{R}{2} = \frac{IR}{8}$ which is half the value for a concentrated load at the centre (Fig. 2). The same values are used as in the other cases.

The maximum volt-drop $= \frac{100 \times 0{\cdot}2}{8} = 2{\cdot}5$ V

and the minimum p.d. at the centre is $250 - 2{\cdot}5 = 247{\cdot}5$ V.

Even though many students have constructed parabolas in the S1 year, the methods are often forgotten so a useful construction is given in the lowest diagram of Fig. 5.

This is self-evident for the point 3 which shows the construction in heavier lines.

These simple examples serve as an introduction and give confidence to students when more difficult examples are encountered.

Two further examples make use of graphical methods similar to those used in applied mechanics. The voltage-drop is obtained from the funicular or link polygon. All the loads are considered as vertical, such as in d.c. distribution or resistance loads on a.c. systems.

Typical Questions

(6) "*A d.c. distributor* 120 *yd long is fed at one end and supplies loads of* 50 *amps,* 30 *amps and* 20 *amps at* 60, 90 *and* 110 *yd respectively from the feeding point. The resistance of both cores of the* 0·04 *in² cable is* 1·25 *ohms*/1,000 *yd. If the* 20*-amp load is to be maintained at* 230 *V, determine the voltages at the feeding point and the other two loads.*"

The distributor and its loads are drawn to scale in Fig. 6 and the loads are lettered according to Bow's notation. As resistance is proportional to length for a uniform conductor, the linear scale of the diagram can be either in yards or ohms, the latter values being given. The *polygon of forces abcd* is a straight line as the load currents are parallel. The total load *da* is the current from the feeder. In this example the current diagram can be drawn directly and is similar to the shear force diagram of a cantilever.

To obtain the voltage-drop the funicular or link polygon can be constructed as follows: take any pole *o* at a convenient horizontal distance *oy*, in this case 3 in. or 0·075 ohm to the linear scale. Join *oa*, *ob*, *oc* and *od* and then draw the sides of the funicular polygon a_1 b_1 c_1 and d_1 parallel respectively to *oa*, *ob*, *oc* and *od*. The vertical intercepts in the line of action of the loads when multiplied by the polar

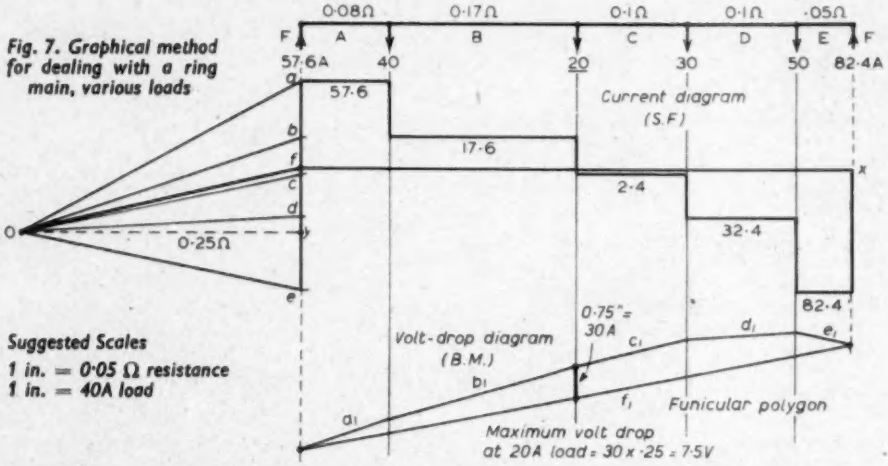


Fig. 7. Graphical method for dealing with a ring main, various loads

distance *oy* give the various voltage-drops. For example, at the 30-amp load this intercept scales 0·17 in. so the voltage-drop is $0{\cdot}17 \times 40 \times 0{\cdot}075 = 0{\cdot}51$ V. (With a current scale of one inch equal to 40 A.) As the 20-amp load is to be maintained at 230 V, the p.d. at the 30-amp load is $230 + 0{\cdot}51 = 230{\cdot}51$ V. There is a small error in this short length, but the other two drops are in reasonable graphical agreement with the calculated values of 2·375 V and 9·875 V at the 50-amp load and the feeding point respectively, so that the values of voltages required by the question are as shown in Fig. 6. The current distribution is not asked for but is easily obtained and completes this graphical exercise.

(7) With a distributor fed at each end at the same voltage or a ring-main, the current distribution cannot be obtained straight away as in the above example, but a similar method when carried through to completion gives the current distribution.

"*A two-wire ring-main is supplied at 240 V. The resistance of each section of the cable is given in Fig. 7 for both cores. Determine graphically the distribution of current and the load with the lowest p.d. and its value.*"

The space diagram is shown lettered according to Bow's notation in Fig. 7 and again the polygon of forces (currents) *abcde* is a straight line. But now the current is fed in at each end and the respective proportions are not known, so the current diagram cannot be completed until the funicular polygon has been drawn to locate the position of the horizontal line *fx* on the current (shear force) diagram. As before, a pole *o* is chosen at a convenient distance *oy* = 0·25 ohm to the linear scale. The funicular polygon is drawn with a_1 parallel to *oa* and so on, the closing side f_1 gives the direction of *of* which enables the base of the current diagram to be located. Then the currents are scaled off as shown in the diagram which is similar to a shear force diagram.

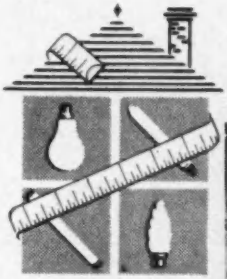
The load with the lowest p.d. has the greatest voltage-drop which is indicated by the maximum intercept which scales 0·75 in. at the 20-amp load. From the current diagram this load is supplied with 17·6 amp from the left and 2·4 amp from the right, so it must be at the lowest potential.

The voltage-drop is $0{\cdot}75 \times 40 \times 0{\cdot}25 = 7{\cdot}5$ V and the lowest p.d. is $240 - 7{\cdot}5 = 232{\cdot}5$ V.

In this example the distance *oy* of the pole *o* is so chosen that the IR drop, a moment, is ten times the length of the intercepts in the funicular polygon as 1 in. to the load scale is 40 amp which multiplied by the polar distance 0·25 ohm gives 10 V.

Electrical and Mechanical

Limitations of time may not permit the frequent use of the graphical methods of the last two examples. But they are useful to show mechanical engineering students that methods with which they are familiar can be used in electrical problems, and also to impress on electrical students the value of a good foundation of mechanical knowledge. Many of the latter think otherwise in the S2 year, and then regret their lack of knowledge when it is necessary to pass in Applied Mechanics to obtain a Higher National Certificate or professional qualifications.



Lighting to Measure

British Thomson-Houston Co. co-operate with Heal and Sons in presenting a live exhibition on Mazda tailored lighting

June Armstrong, Heal's Exhibition organiser, sets the rule on interior lighting

CONVINCED that their campaign to improve the nation's home lighting had the right approach the British Thomson-Houston Company recently revised and re-issued as a second edition their useful little booklet on "Lighting to Measure."

As readers will probably know the booklet attempts to convince, in a practical way, the lay man—and woman—that those few extra inches in position and that extra lamp or two make all the difference.

The company went a step further and in co-operation with Heal and Sons, have staged an exhibition of their ideas and recommendations in the Mansard Gallery at Heal's.

A number of "rooms" designed and furnished by Heals, to correspond with those in the booklet, all illustrate by means of "tape-measures" the Mazda idea of tailored lighting. These can be contrasted with a sitting room which purposely is badly lighted.

The choice of venue is a happy one for the new edition of "Lighting to Measure" illustrates contemporary living, but the company emphasise that these recommendations are easily adaptable to any interior style.

Such an exhibition of lighting as this in a place which attracts very many young people planning their homes and the not so young as well, is doubly important when it is realised that "more than 800,000,000 hours are lost annually by Britain's industries through bad eyesight and inadequate lighting in shops, offices, homes and factories" to quote Mr. A. E. Turville, President of the Association of Optical Practitioners, speaking last week before the opening of the Exhibition.

Good lighting, Mr. Turville said, is equally important in the home since so much of our time is spent under artificial lighting during the winter months. In general most people use insufficient light in their homes and the optical profession's work in protecting the nation's eyes is being hampered by lack of sufficient understanding of the importance of good lighting in homes, schools and industry.

Gone were the "hit and miss" methods of pre-war days, said Dame Caroline Haslett, D.B.E., J.P., Director, E.A.W. and Chairman E.D.A., at the preview. Today lighting which provided beauty and efficiency was available for everyone at a very reasonable cost.

Two set pieces illustrating the lessons of "Lighting to Measure" and showing the "Tape Measures" in use

overseas news

Power Exchange

Cables have been suspended across the Detroit River this month between the Detroit Edison Co.'s Delray power plant and the Clark Keith power station of the Hydro Electric Commission of Ontario, at Windsor, in preparation for a large international power exchange. A second set of cables is to be strung across the St. Clair River between Marysville, Michigan, and Sarnia, Ontario. Each system will have a capacity of 150 MW. The Detroit Co. has already received approval of the scheme from the Federal Power Commission, but there has to be a waiting period before the exchange can start. Mr. R. H. Saunders, chairman of the Commission, has said he hoped the exchange with the Michigan system would end the provinces present power supply problem and provide the necessary protection for water storage. In the first few weeks of the exchange, expected to take place this month, about 20,000 kW will be fed into the Ontario system. Later, during periods of high water levels in Ontario, the Power Commission will reverse the flow, sending power to Detroit where it is now being generated at steam stations.

Atomic Conference

A three-day symposium on electric power was held at Chalk River, Canada, last week. It was attended by representatives of Atomic Energy of Canada Ltd., and four of the leading power utilities—the Hydro-Electric Power Commission of Ontario, the Quebec Hydro-Electric Commission, Shawinigan Water and Power Co., Calgary Power Ltd., and other concerns. It was Canada's first conference intended to interest commercial concerns in the application of atomic power to industry. The idea was to allow power companies to become better acquainted with research results obtaned at the Chalk River atomic establishment, and at the same time give the staff of the latter an insight into many of the problems of power production and distribution.

Kafue to be First

The question of whether the Kafue or Kariba hydro-electric scheme should be started first seems to have been settled at long last. The Kafue project is to be tackled first. This was revealed in a statement by Sir Godfrey Huggins last week. Agreement has been reached that the scheme is to be regarded partly as a Northern Rhodesian one and later as a federal Government project when this assumes responsibility. Mr. R. A. Nicholson, Economic Secretary of the Government of Northern Rhodesia intimated that his Government had been able to convince the Government of Southern Rhodesia that the earliest possible completion of the Kafue scheme was essential to safeguard an adequate supply of power to the copper mines. It was also agreed to carry out the first stage of the Kariba project as soon as possible after work on the Kafue scheme had begun. The next move is to obtain the necessary finance. In Rhodesia, the copper mining concerns are now confident that power from Kafue may be available at roughly the same time as greatly increased demands will be made by the industry. There is already an interim plan to obtain additional power from hydro-electric sources in the Belgian Congo but the industry considers that only an adequate power source in Northern Rhodesia would solve their problem.

Indigenous Manufacture

Carbon brushes for use in electric motors are now being produced for the first time on a pilot plant scale at the National Physical Laboratory, New Delhi, it has been announced. The Laboratory is now in a position to manufacture various types of carbon articles for both Government departments and industrial concerns.

Karachi's Trouble

The 6,000 kW diesel power station of the Karachi Electric Supply Corporation Ltd., at Elender Road, was recently flooded to a depth of 4 to 5 ft as the result of cyclonic rains, and the plant had to be shut down temporarily to avoid serious damage. With the assistance of the local fire brigade, the water was pumped out but each machine had to be dried out. The company's steam station, where additional plant was undergoing tests, although slightly affected, was able to carry most of the peak load. One difficulty was, however, that the interconnector between the steam and diesel power stations had broken down and could not be repaired immediately on account of the flooding of the roads. The company appealed to consumers to restrict their demands so that the peak load could be kept down to about 13,000 kW instead of the more usual 17,000 kW.

Ceylon Needs Finance

The Government of Ceylon has asked the International Bank for Reconstruction and Development for a loan of Rs. 8 crores (approximately $15 million) for the completion of the second stage of the island's hydro-electric plan. The first stage was completed some years ago.

Canadian Help?

The Government of Assam has requested Canada to supply the State equipment and machinery under the Colombo Plan for its Umtru hydro-electric project. Mr. Sampath

Iengar, superintending engineer of Mysore, has been appointed project officer of Umtru. Representatives of the Canadian Government have already visited Assam to survey the scheme. Situated near Gauhati, it is designed to generate 7,500 kW.

Victoria's Record Surplus

The State Electricity Commission of Victoria achieved a record net surplus of over £300,000 in its operations in the financial year just ended, said Mr. R. A. Hunt, chairman of the Commission, a few days ago.

Commenting on the preliminary figures, he said the Commission would be able to strengthen its special reserves for the first time in four years. No tariff reduction could be made immediately because finance had to be assured for contract commitments, rural extensions, etc. The year's revenue increased to £20,750,000 but expenditure also rose to £18,800,000. He attributed the improvement to (a) the record breaking performance of Yallourn and the hydro-electric stations; (b) application throughout the year of 20% higher tariffs; and (c) cuts in the Commission's fuel bill as the result of greater production of raw brown coal and water power.

Spencer Street on Load

Melbourne City Council's new 30,000 kW power station in Spencer Street was connected to the State electricity system recently. Present capacity is a third of the ultimate output, which should be reached in March next. The station will then be the third largest in Victoria.

Another 15,000 kW generator and two boilers have yet to be installed. The station is operating on oil fuel, but can operate on coal, coke, oil or briquettes.

The chairman of the Electricity Supply Committee (Cr. Nilsen) said construction of the station had been kept within the 1950 estimate. So far, £2,556,000 had been spent.

Hydro Outlook in N.Z.

The entire hydro-electric potential of New Zealand's North Island lakes and rivers will be used up by 1960 or 1970, according to the 1953 Economic Survey of the Prime Minister, Mr. S. G. Holland. New Zealand will then be faced with the necessity to supplement hydro-electric generation in the North Island with other forms of generation, or with other fuels, or with electric power from the South Island which involves technical problems yet unsolved of transmission across Cook Strait, he states. If transmission difficulties could be overcome, adequate supplies of electric power could be assured for the rest of the century at least, for at present only about one twenty-fifth of the hydro-electric potential of the South Island had been tapped. Earlier, Mr. L. F. Withers, assistant general manager of the State Hydro Electric Department, had given the potential hydro-power of the North Island as 1,250 MW and of the South Islands as 5,500 MW. He considers the laying of a cable across Cook Strait is technically feasible, but any repair work necessary would be a difficult operation in view of the depth of the water.

Use of Galvanised Wire

Galvanised iron wire, which in recent years has been used fairly considerably in New Zealand electricity distribution systems because of the shortage and comparative high price of copper, is now only to be used on short line work. The Bay of Islands Electric Power Board, for instance, at its recent meeting, agreed that No. 8 galvanised wire should be used only on short extensions where the power loss would not be so great. It was pointed out that such lines could easily be rewired at a later date when copper became more readily available. The North Auckland Power Board also has about 800 miles of galvanised iron wire, and at its meeting last month, it was stated that 150 miles of this would have to be replaced in the near future. Mr. P. A. Griffin, the engineer, explained that in the past the Board had been obliged to accept galvanised wire of poor quality, and this, with the tendency to strain the wires tightly, was probably the cause of a more rapid deterioration, but the department had no evidence of a greater percentage of line breaks occurring in galvanised iron lines than in other conductors.

System Development

The Hawke's Bay Electric Power Board, New Zealand, plans to spend a total of £196,650 on augmenting its supply system over the next four or five years. This expenditure does not include the rural extension programme which is also to be carried out.

Decision Awaited

No decision had yet been made on the possible construction of a hydro-electric scheme on New Zealand's Waikato River north of Wairakei and near the Aratiatia Rapids. This was announced by the Minister in charge of the State Hydro-Electric Department recently. It had been previously stated that the Minister of Works was preparing a report on the practicability of such a scheme and the borings which were proceeding were part of that investigation.

Supply for Tuaran

In the absence of any tenders for minor electrical undertakings to supply Tuaran, North Borneo, the Public Works Department placed orders for the supply of two new engines in order that two 25kW diesel alternator sets could be transferred from Jesselton and Labuan for installation at Tuaran.

Without waiting for their arrival the P.W.D. went ahead with the construction of the local distribution systems so that when the alternators arrived the system was in operation in time for the Coronation.

Supply is 400/230 V a.c. 50c/s and the cost per unit is 50c. To date 72 consumers in addition to Kent College, are receiving supplies.

PERSONALITIES

IN THE INDUSTRY

Following the promotion of **Mr. H. W. Grimmitt,** M.I.E.E., A.M.I.Mech.E., to chief engineering inspector at the Ministry of Fuel and Power, **Mr. A. H. F. Linton,** D.F.H., A.M.I.E.E., has been appointed to fill the vacancy of deputy chief engineering inspector. Mr. Linton has been engineering inspector for the past five years. An old Faraday House student, he gained early experience with the Outside Contracts Department of Johnson and Phillips Ltd., after which he spent a year with the Peterborough Corporation Electricity Department. He joined the former Electricity Commission in 1937 as an engineering assistant and was appointed an engineering inspector (grade 2) just before the war. During the war he was an electrical officer, R.N.V.R., on degaussing work, leaving the Navy in 1946 as electrical lieut.-commander, to return to the Electricity Commission, and was transferred to the Ministry of Fuel and Power in 1948 when the Commission ceased to function.

Mr. A. H. F. Linton

Three changes in organisation are announced by the Metropolitan-Vickers Electrical Co. Ltd., **Mr. T. R. Porter,** M.B.E., who since February 1949 has been superintendent, Control and Radio Department, becomes superintendent, Control Department; **Mr. E. T. W. Barnes,** A.M.I.Prod.E., is now superintendent of the Radio Department, and **Mr. A. J. R. Veale,** Grad.I.Mech.E., Assoc.M.T.C., is appointed assistant superintendent Radio Department. Mr. Porter was early introduced to production work after completing his trade apprenticeship with the company. Initially he was placed in charge of the Railway Signal and Train Lighting production sections attached to the Traction Department. In 1934 he was appointed senior production engineer, and in 1936 was given charge of production on early defence contracts and continued as senior production engineer on searchlights and sound location in the Gun Carriage Department until 1938. Then he was placed in charge of radar production and in April, 1944, was appointed assistant superintendent Transmitter Department. Mr. Barnes, after spending six years with the New South Wales Government Railways, joined M.V. as a college apprentice in 1930. He entered the Meter Department in 1932 and since then has been engaged on the manufacturing side. Since August 1948, he has been assistant superintendent, Instrument and Meter Department. Mr. Veale, who has been assistant superintendent, Control and Radio Department since February, 1949, was educated at Exeter School and joined M.V as a school apprentice in 1937, later serving in mechanical departments until transferring to Detail and Transmitter Department in January 1941, where he remained till 1949. During part of this time he was engaged on development of radar and industrial and traction control.

Mr. T. R. Porter

Mr. E. T. W. Barnes

Mr. A. J. R. Veale

At present deputy station superintendent at Chadderton L.P. power station, North Western Division, B.E.A., **Mr. K. Ford,** A.M.I.E.E., A.M.Inst.F., has been appointed to a similar position at the Chadderton H.P. station with effect from October 1. He served his apprenticeship with Metropolitan-Vickers Electrical Co., and after a period with the North-Eastern Electric Supply Co., Ltd., worked in the Nottingham Corporation electricity undertaking from 1938 to 1945. Going to Ferrybridge power station of the Yorkshire Electric Power Co. in 1946, he later became charge engineer at Chadderton power station. He then became efficiency engineer at both the Greenhill and Chadderton stations and in July, 1950, was appointed deputy station superintendent at Chadderton L.P. station.

Mr. A. Lockwood, chairman of the Southern Electricity Consultative Council has announced that he is retiring on September 30 next, on the termination of his term of office. **Group Captain J. C. M. Hay** has accepted the invitation of the Minister of Fuel and Power to succeed Mr. Lockwood as chairman of the Consultative Council.

Inducted this week as president of the Association of Public Lighting Engineers is **Mr. C. C. Smith**, A.M.I.E.E., city lighting engineer of Liverpool, who has some 34,000 lamps in approximately 1,000 miles of streets and passages under his charge. Educated at Oldershaw Secondary School, Wallasey, he served an apprenticeship with the Liverpool Corporation Electric Supply Department in the mains section of which he subsequently served in various capacities until July 1940 when he was commissioned in the Army. After war service he returned to Liverpool as engineering assistant (distribution) in the Corporation Electric Supply Department, but in 1946 was appointed deputy city lighting engineer there, ultimately being promoted to his present position in April, 1948.

Mr. C. C. Smith

This week, **Mr. D. D. Shears** has taken up his new duties as deputy power station superintendent at Westwood generating station, North Western Division, B.E.A. Formerly mechanical maintenance engineer at Skelton Grange power station, Mr. Shears started his career with the Horsham (Sussex) U.D.C. Electricity Department, and from 1938 to 1940 worked at the Valley Road generating station, Bradford. Returning there after war service in the Royal Navy, he became shift charge engineer before taking up a similar post at Skelton Grange, where he was later appointed mechanical maintenance engineer.

A prominent, and popular, official who is due to retire at the end of this month is **Mr. H. W. Swann**, O.B.E., M.I.E.E., H.M. senior electrical inspector of factories. Well known throughout the Industry—there can be few members who have not met him at various times—Mr. Swann will be greatly missed, but we have a strong feeling that we shall have the pleasure of his company at many functions yet—at least we hope so. Mr. Swann, of course, has been senior electrical inspector of factories since 1930, in which capacity he has been adviser to the Ministry of Labour and National Service on a wide range of electrical subjects. Born in Cambridge in 1883, he was educated at the Perse School before going to Faraday House in 1902 for technical training. After some manufacturing experience, he held appointments with Metropolitan Electric Tramways and the North Metropolitan Electric Power Co. before becoming a Home Office inspector in 1922. Mr. Swann has served on the Council of the I.E.E. and the General Council of the B.S.I. and on numerous committees of both institutions. For many years he has been actively associated with the work of the Association of Supervising Electrical Engineers, of which he was president from 1939 to 1944. In his address to that Association in 1941 Mr. Swann drew attention to the need for a test to ensure the competency of the engineer in electrical work, and in 1945 the Swann Diploma Scheme was inaugurated by the A.S.E.E. (in recognition of his valuable work) providing for tests to indicate a standard of ability. A very likeable character, we hope Mr. Swann will continue to enjoy good health and happiness for many years to come.

Mr. H. W. Swann

Miss June Oddy has joined the demonstration team of the English Electric Co. Ltd. Since 1951, Miss Oddy has gained a wide experience of demonstration techniques working in electricity showrooms, shops and stores all over the country while working for the Nestle Co. Educated at Wakefield Girls' High School, she trained at Battersea Domestic Science College, where she took a Teacher's Diploma in cookery, housewifery, laundry work and social science. She then returned to teach at Wakefield Manygates School.

Miss June Oddy

Following the recent retirement of **Mr. A. N. Khosla**, I.S.E., from the position of chairman of the Central Water and Power Commission of India, the Government has appointed **Mr. T. Sivashankar**, I.C.S., formerly secretary of the Ministry of Irrigation and Power, to fill the vacancy.

Mr. L. E. Mold has resigned his directorship of C. A. Parsons and Co., Ltd.

District commercial manager of district 346 of the South Wales Electricity Board, **Mr. T. R. Evans**, M.I.E.E., is retiring in October 2. Mr. Evans has been associated with the Electrical Industry throughout his career, and prior to nationalisation played a prominent part in the industry's affairs in South Wales, being honorary secretary of the Bulk Supply Association of South Wales and Monmouthshire for many years, and honorary secretary and treasurer of the S.W. England and South Wales centre of the I.M.E.A. He also served as an executive member and deputy chairman of the South Wales and Mon. Centre of E.D.A., and as an executive member of the S.Wales and S. Western Centre of the I.E.E. Educated at Merthyr County School, he was apprenticed to Harry Parfitt Ltd., in 1900 and gained electrical

experience with the Glamorgan Colliery Co. In 1908 he became shift charge engineer to the Rhondda Transport Co., and was later appointed chief assistant engineer to Mr. H. J. Nisbett, M.I.E.E., the companys first general manager. In 1914, Mr. Evans joined the Rhondda Council undertaking as chief assistant engineer, serving in that capacity until 1937, when he was appointed the Council's electrical engineer and manager. His many friends in the Industry will wish him a long and happy retirement.

Mr. R. A. Riddles, C.B.E., M.I.Mech.E., M.I.Loco.E.' who, since October, 1947, has been the full time member of the Railway Executive responsible for mechanical and electrical engineering, and who was formerly a vice-president of the London Midland and Scottish Railway, is to retire from the railway service at the end of this month.

Mr. E. Carnegie has resigned from the Board of Metal Industries Ltd., on reaching the statutory retirement age, but he remains chairman of the company's Electrical Division.

Mr. F. H. Page, who has served with W. T. Henley's Telegraph Works Co. Ltd., as a representative in the London area for nearly 28½ years, retires tomorrow September 18. He is succeeded by **Mr. B. F. Green,** who was a member of the office staff of Henley's London branch and who commenced with the Company as a junior in 1922.

The Minister of Fuel and Power has re-appointed **Mr. J. M. Airlie** as chairman of the South East Scotland Electricity Consultative Council.

On Thursday last **Mr. B. L. Perkins,** B.Sc.(Eng), A.M.I.E.E., general sales manager, Foster Transformers, Ltd., left this country for an extensive business tour of East and South Africa on behalf of the Foster Company and other companies in the Lancashire Dynamo Group. Apart from calling on important customers and the company's agents in East Africa, he will visit Lancashire Dynamo South Africa (Pty.), Ltd., of Johannesburg, and sub-agents throughout their territory.

We have advance news that **Mr. A. W. Knight,** M.E., B.Sc., B.Com., M.I.E.Aust., State Hydro Electric Commissioner of Tasmania, is to leave next year for an overseas tour to inspect the latest power developments. It is probable that he will leave about next April, and that he will visit the United Kingdom, Europe, America and Canada.

The Air Ministry has announced that **Air Commodore Brian David Nicholas** is to become Director of Radio Engineering at the Air Ministry on September 21, on relinquishing the post of Air Officer Commanding No. 27 Group, Technical Training Command, which he has held since January, 1952.

Formerly with the Operations Department of Air, India, **Mr. F. C. Serrao** has joined Oldham and Son (India) Ltd., in charge of the technical side of the company's Indian mining installations.

OBITUARY

Sir Harry Haward, comptroller of the London County Council for many years, who was one of the original five Electricity Commissioners, died on September 8, aged 90.

Mr. A. J. Mansell, general secretary of the Institute of Industrial Supervisors since its formation in 1948, died on September 10, aged 42.

Mr. F. P. I. Crossley, a director of Crossley Brothers Ltd., and grandson of the chairman of that company (Sir Kenneth Crossley), died on August 26.

Mr. G. Adam, formerly manager of the Edinburgh branch of the Sloan Electrical Co., Ltd., died on September 10, aged 65. He served with the company for 43 years, retiring in May, 1949.

NEW LITERATURE

Electric Resistance Heating

VOLUME 5 in the E.D.A. "Electricity and Productivity" series, this book treats of the simplest form of electric heating. It includes a description of the many types of apparatus involved, with particular attention to their advantages in the particular industrial process in which each is concerned. There are some useful notes on installation for minimum heat loss, and thus for minimum expense. As with all this series, illustrations are numerous and well-selected. Published by the Electrical Development Association, 2 Savoy Hill, London W.C.2, 182 pages, 8½ in. by 5½ in. Price 8s. 6d.

Welding Technology

by F. Koenigsberger, Dipl. Ing., M.Sc.Tech.

THE appearance of a second edition at an early date is a well deserved tribute to the qualities of this valuable book. Apart from general revision, the author has taken the opportunity of adding a chapter on the welding of thermoplastic materials, For the rest, the volume retains its former arrangement. A general discussion of the principal features of fusion and forge welding is followed by notes on the welding of ferrous and non-ferrous metals respectively. Plant and equipment is dealt with at some length, with useful sections on electrical equipment for arc and resistance welding. Finally, there are chapters on practical aspects of welding. Published by Cleaver-Hume, 341 pages, 8½ in. by 5½ in. Price 25s.

BOOKS RECEIVED

Electrical Installation Rules and Tables, by W. S. Ibbetson, designed for rapid reference for installation engineers, electricians, contractors and architects. Fifth edition, published by Spon, 210 pages, 5 in by 3¼ in. Price 7s. 6d.

D.C. Generators and Motors, by J. E. Macfarlane. Introduction to the subject as part of Elementary Electrical Engineering Practice series. Published by Pitman, 99 pages, 7¼ in by 4¼ in. Price 8s. 6d.

The BUYER'S *Column*

"Pylon" Aluminium Kettle

NOW offered to the trade by PREMIER ELECTRIC HEATERS LTD., Keeley St., Birmingham, 9, is the "Pylon" kettle in polished heavy gauge aluminium, Catalogue No. 2833.

The Pylon in polished aluminium

Extra features of this model include a new easy-pour streamline spout, a plastic handle reinforced with steel strip, and a highly polished finish.

Fully protected by automatic cut-out the aluminium "Pylon" costs only 52s. 6d. for the 1 kW model and 55s. 6d. for 1½ kW model.

Improved "Warmabed" Element

A NEW improved version of the "Tempomatic" element as incorporated in the Warmabed electric blanket is announced.

The new element employs an asbestos core, a new plastic covering and an all-over finish of tight asbestos braiding, and is flexible and strong, and in view of its neat construction is almost imperceptible in the blanket.

These blankets are available in four colours—gold, pink, blue and green—and are supplied in the double size £12 7s., single £8 11s., junior size £4 15s., all prices including tax.

An auto-transformer temperature regulator was introduced recently, working with a five-step switch to give accurate heating. This is priced £3 17s. 6d.

The makers are MODERN ELECTRICAL INDUSTRIES (NORTHERN) LTD., Hollinsworth Lane, Knottingley, Yorks.

E.E. C.r.t. Reconditioning

A CATHODE ray tube reconditioning service has been instituted by the ENGLISH ELECTRIC CO. LTD., Queens House, Kingsway, London, W.C.2.

Thus under this new service when the time comes that a c.r. tube has to be replaced it will be available with the same guarantee as for a new tube but at half the price.

Present list price of an English Electric 16 in. metal c.r.t. type T900 or T901 is £16 plus Purchase Tax £6 4s. 10d. = £22 4s. 10d. The list price of a reconditioned tube has been fixed at £12 subject to normal trade discount and no Purchase Tax. This service will not only apply to new sets but to all sets in which an E.E. metal c.r. tube is incorporated.

Sturdy increase Transformer Range

INCREASE in manufacturing capacity achieved by extended design and production facilities now permits STURDY ELECTRIC CO. LTD., of Burnopfield, Newcastle on Tyne, to enlarge the range of transformers they manufacture from a former maximum size of 50 kVA up to 100 kVA.

This company makes transformers for power supply and general industrial use. We understand they are at present developing an arc welding transformer working on the magnetic leak principle and will give more details in a subsequent issue.

Hire Purchase for Simplex Cookers

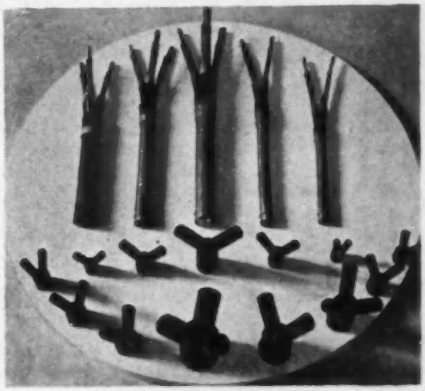
TO help caterers in holiday resorts who have seasonal trade SIMPLEX ELECTRIC CO. LTD., Broadwell, Oldbury, have introduced a hire purchase scheme for the Creda 6-16-60 range formerly called the "Restaurant Range."

B.I.C.C. Cable Sleeves

WHERE sealing by more orthodox methods is considered unnecessary BRITISH INSULATED CALLENDER'S CABLES LTD. offer a range of newly developed polychloroprene sealing sleeves for terminating cables used in normally dry conditions.

These sleeves have been developed for use on medium voltage two or three core cambric-insulated cables and are particularly suitable for ship wiring. The range however is soon to be extended to cater for mass-impregnated non-draining power-cables for industrial installations.

The sealing sleeve fitted over the prepared cable end as shown in the illustration is valuable where space is a consideration and where the more complete protection afforded by a compound-filled box is not warranted.



Samples of the B.I.C.C. sleeves

"Corrilux" Lighting

The Corrilux fitting

NEW inexpensive bulkhead lighting fitting, the "Corrilux" (Catalogue No. L.210), is now in production, say SIMPLEX ELECTRIC CO. LTD., Broadwell, Oldbury, Birmingham.

Priced at 27s., the "Corrilux," which is for gas filled lamps up to 100 watts, has a strong non-corroding, non-fracturing aluminium alloy body. Weather and dust proofing features are well above average due to the unique method of fixing the front glass, whilst secret key operation prevents tampering.

The "Corrilux," suitable for surface and semi-recessed fixing, gives good general illumination with minimum glare, and the satin exterior finish, whilst attractive in itself, is also an ideal surface for painting on site.

Ediswan Heavy-Duty Charger

A TWO-RATE heavy-duty battery charger was recently supplied by THE EDISON SWAN ELECTRIC CO., LTD., 155 Charing Cross Road, W.C.2, for use on a 500/550 V, 3-phase supply and capable of charging a 125 cell 504 ampere-hour lead-acid battery.

The maximum initial charge rate is 50-amps, tapering to approx. 25-amps at the end of charge. An alternative trickle charge of 500/700 milli-amperes can be delivered.

The equipment can be used with the battery floating, and a constant load of 10 amps imposed on the circuit. To enable the output to be correctly adjusted for these conditions a centre zero reading ammeter is fitted.

The charger is constructed in two sections, a floor-mounting tank housing the transformer and having mounted thereon the control gear and a wall mounting case accommodating the selenium rectifier elements.

Mazda Flashlamps

TWO new introductions in the "Mazda" flash-lamp range are announced by the BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.

First is a lens end flashlight lamp which gives a controlled beam of light without the use of a reflector. The uniform beam of light of good intensity and controlled angular spread has been achieved by incorporating a precisely moulded lens in the crown of the lamp, and locating a specially shaped filament a fixed distance from it. The lamp is priced 8½d. including purchase tax (2·2 V, 0·25 amp).

The second lamp (2·5 V, 0·3 amp) is designed for use in flashlights fitted with prefocused lamp-holder reflector units. It produces a high-intensity "spot" beam.

The necessary exact positioning between the filament and the reflector is achieved by positioning the filament within the lamp in a fixed relationship to a seating collar embodied in the cap whilst the precise positioning of the lamp in relation to the reflector unit and lampholder is by three raised "vee" edges on the collar periphery.

Each lamp is tested to ensure that the filament is exactly located at the light centre point. Price 1s. 2d. including purchase tax.

Philips reduce Pig Farrower Price

A REDUCTION in the price of their infra-red pig farrowing units is announced by PHILIPS ELECTRICAL LTD., Century House, Shaftesbury Avenue, London, W.C.2. These now cost 59s. each, including two 250 W infra-red heaters. There is no Purchase Tax. The company emphasise that one of these farrowing units is ample for up to twelve piglets from birth to weaning and point out their use in rearing calves and poultry.

TRADE PUBLICATIONS

LIGHTING.—Thorn Electrical Industries Ltd., 105 Judd Street, London, W.C.1, have now published a new Lighting Fittings Handbook for tungsten filament lamps.

GENERATING SETS.—"Brodask" diesel petrol generating sets are illustrated in a pamphlet issued by Brodie and Askham Ltd., 30 Kennington Lane, London, S.E.11.

CIRCUIT-BREAKERS. — Publication 41166-A issued by Brush Export Ltd., Loughborough, Leics., deals with outdoor oil circuit-breakers built by the company with special reference to the American and Canadian markets.

MOTORS.—The latest publication of Newman Industries Ltd., Yate, Bristol, is a catalogue of flameproof motors.

TRANSFORMERS.—A new catalogue is available from Denis Ferranti Co. Ltd., Royton, Oldham, Lancs, featuring detailed information about the range of equipment.

AIR CONDITIONING.—Publications B531 and FB532 feature "Electro-PL" air filters and small cast blowers for electronic and other applications. Both are products of Air Control Installations Ltd., Ruislip, Middx.

MOTORS.—The September issue of the Stock List is now available from Higgs Motors Ltd., Witton, Birmingham 6.

ALARMS AND INDICATORS.—Revised Price List of Sax electrical products has been issued by Julius Sax and Co., Ltd., 24 Commerce Road, Brentford.

The WEEK in NEWS

Australia allows 10% More Imports

Year's Third Relaxation will mean £A45m more Goods

RESTRICTIONS on imports into Australia, imposed originally in March last year, have been relaxed further. This was announced by the Prime Minister, Mr. R. G. Menzies, last Friday, following the Budget statement which showed a great improvement in the Commonwealth's balance of payments and international reserves, and favourable export prospects. As the Government's policy is to lift the ban on imports as soon as possible, this situation made an easing of controls practicable. Consequently quotas for imports from sources other than dollar countries and Japan will be increased by a further 10% on the base year 1950-51. In addition a number of items are to be placed on a "no quota restriction" basis. Hitherto the goods concerned were under administrative control, but they can now be licensed freely provided importers can show the goods can be imported within a year. A third alteration is that the level of imports from Japan is to be raised in line with the increase from non-dollar countries.

The overall result of these relaxations will be to permit a further £A45 million of goods into Australia. It is, incidentally, the third time this year that controls have been eased. Previously, the level of licensing of Category A goods (wire, switchboards, etc.) was 80% of the base year, and of Category B goods (domestic appliances, etc.), 40%. Items placed on the "no quota restriction" list include insulating materials, navigation lamps, parts for portable handtools and scientific instruments.

One other decision taken, is that as from October 1, the quarterly licensing periods will be superseded by six-monthly periods. This will facilitate the ordering of goods by importers and help them to attain a more satisfactory stock position.

Further 124 Miles of Cable for Russia

YET another Russian contract has been placed in this country. Contracts worth £3¼ million have been reported in these columns during the past few weeks. Latest successful firm is Aberdare Cables Ltd., who are to supply 124 miles of h.t. cable for distribution lines. The order was placed by the Russian trade delegation in this country and a representative of the company visited Moscow a short time ago to complete the transaction. We understand that export licences have been granted by the Board of Trade, and monthly shipments will follow until the end of this year.

Electricians' Dispute in its 4th Week

THE wage dispute between the E.T.U. and the National Federated Electrical Association continues, and the strike has passed into its fourth week. For the second time since electricians stopped work on August 24 the Ministry of Labour has stepped in to try to end the deadlock. An independent Court of Enquiry has been set up and the first meeting is expected to take place today (Thursday). The N.F.E.A. agreed to comply with a request to withhold any action contemplated provided the strike was called off meanwhile. The Union later recommended that the strike be called off during the inquiry.

Towards the end of last week it was threatened that employees in Scotland would also be called out, but an immediate extension of the strike was thought unlikely. Scottish employers rejected the Union's claim on similar grounds as their colleagues in London. On Tuesday morning it was estimated that about 4,500 were on strike on 100 sites.

The First Half-Century

In his Presidential Address to the British Association, Sir Norman Lockyer deals with the endowment of education and research. He regards the foundation of eight new universities and an expenditure of £24 million as necessary to bring our institutions for teaching science into line with Germany and the States. The Government is to find the money and members of the B.A. are to form a Science League to bring the necessary pressure to bear. It is doubtful whether the present or any other Government dare spend £24m. on bricks and mortar, and equally doubtful whether money spent would be of benefit to the country. What is required is not more teaching institutions, but better equipment and endowment of those in existence, and a more thorough training for present students.—*From our issue of September* 17, 1903.

Rural Electrification and Wages

Resolutions discussed at Trades Union Congress

DURING last Thursday's proceedings of the Trades Union Congress at Douglas a strong plea was made for acceleration of rural electrification schemes. A resolution, referred to the General Council, requested the Minister of Fuel and Power to complete in the shortest possible time, the electrification of rural areas. It incorporated an amendment seeking the restoration of the 1951 cuts in capital expenditure.

Proposing the motion, Mr. J. Stewart, of Ipswich, said that in view of the target for increased production in agriculture, the hastening of rural electrification was essential. The labour force was declining, but electricity, by making the work more attractive, would help to retain the younger workers. Mr. Stewart asked also that supplies be taken to the farm workers' houses. Electricity, he said, could make life in rural areas much more attractive. Mr. Stewart also stated that only 41% of farms in the B.E.A.'s area were connected. The remainder were being connected at the rate of about 9,000 a year, which meant it would take 20 years for all farms to receive a supply. The General Council agreed that the resolution should be submitted for their consideration.

On the same day a resolution demanding action to gain further wage increases, suggested by the Electrical Trades Union, was heavily defeated. Moving the resolution, Mr. W. Stevens said increases were justified by the rising cost of living (the Union's case in the existing strike of contracting employees), and could be met by profits and not be reflected in rises in prices. Another resolution which rejected any form of wage restraint which might interfere with freedom of collective bargaining and independent arbitration, was, however, agreed. This called for a vigorous attempt to force the Government to stabilise the cost of living and, if need be, reintroduce food subsidies.

MOTOR CONTROL

A COURSE of eight lectures on Electronic Motor Control is being arranged by Bradford Technical College's Dept. of Electrical Engineering. The series begins on September 30 and will continue on each succeeding Wednesday evening. Students should have a degree or higher national certificate in electrical engineering or similar qualification, although we understand exceptions may be made. Applications should be made to the Principal. Fee for the course is 30s.

Board Increases Repair Charges

RISING costs have forced the Yorkshire Electricity Board to increase installation and repair work charges in council houses made to Dewsbury Corporation. A letter to this effect stated that future accounts will bear on-costs of 40% for labour and 33⅓% for materials. Hitherto the charges have included on-costs of 20% for both. As a result of this notification, the Corporation's housing committee has decided to obtain prices from local private electrical contractors. A list of suitable contractors who could carry out installations and repairs to the council houses is being compiled.

OFFICIAL PUBLICATIONS

EXPORT CREDITS AND MONOPOLIES AND RESTRICTIVE PRACTICES COMMISSION. 14th Report of Select Committee on Estimates.—Departmental Replies (*see page* 541). H.M.S.O. 6d.

RADIO RESEARCH. D.S.I.R. Special Report 28: Measurement of Atmospheric Noise at High Frequencies, 1945-51. H.M.S.O. 1s. 9d.

CENSUS OF PRODUCTION. Building and Contracting, Gas, Electricity and Water. Report for 1950 (*see page* 524). H.M.S.O. 1s. 6d.

Manchester Display on Fuel Efficiency

PRELIMINARY programme for the Fuel Efficiency Exhibition, which opens in Manchester on November 18, was issued last weekend. The Combustion Engineering Association is to hold its dinner at the Grand Hotel on Wednesday evening, and at their meeting the following day there are to be papers on "Fuel Firing of Coal and Oil," and "Efficient Use of Gas and Electricity in Industry." Speakers on the latter subject will be nominated by the industries concerned. Papers to be delivered on the Friday will be on "Instrumentation and Automatic Control" and "Heat Conservation and Process Steam." The special days for particular regional industries have already been referred to in these columns earlier. Special exhibits include one on Fuel Efficiency in Industry, and another on Power and the Future. The latter is to be provided by the B.E.A. and shows examples of wind and tidal power, gas turbines, cross-channel power transmission and atomic power.

A special appeal to amateur gardeners and commercial growers was made at this year's display of the S.E. Scotland Electricity Board at the Royal Caledonian Horticultural Society's autumn show in Edinburgh

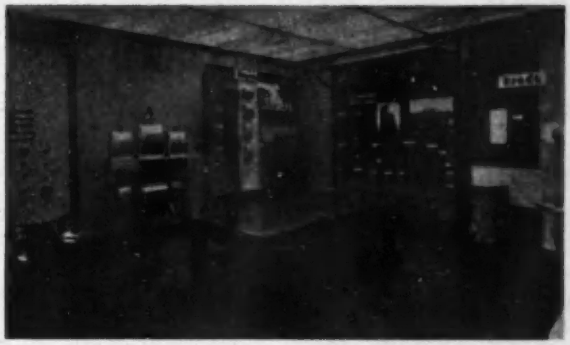
More Publicity for E.C.G. Dept.?

DEPARTMENTAL replies to reports of the Select Committee on Estimates on export credits and on the Monopolies and Restrictive Practices Commission were published last week. As regards the former report the Export Credits Guarantee Department state they have contacted the F.B.I. in order to publicise their activities, and that branch officers have been told to contact local Chambers of Commerce to discover non-exporting manufacturers who might be willing to enter foreign markets. Planned and co-ordinated efforts by branch officers were considered the most suitable way of advertising the facilities offered by the E.C.G.D., but every effort would be made to advertise the Department's services.

Replies to recommendations by the Monopolies Commission were mainly concerned with the employment of professional industrial advisers.

E.A.W. Conference

A PRELIMINARY notice was issued last weekend by the E.A.W. concerning their annual conference in 1954. This, the 29th annual conference of the association, is to take place at Torquay, between May 17 and 20. The programme and further details will, of course, be announced at a later date.



A corner of the new showroom opened by Simplex Electric Co., Ltd., at their head office and works at Oldbury, Birmingham

NEW CABLES FOR S. AFRICAN PROJECT

AN extension of a contract awarded to British Insulated Cables (South Africa) Ltd. in 1951, has just been announced. This latest order involves the supply and laying of 66 kV cables, to carry a further 43 MVA per feeder between Salt River power station and the new substation at Oakdale. It may be recalled that this company installed three 33 kV cables between the power station and Oakdale substation, and two similar cables to the Elsies River substation two years ago. It was later found that they were operating at 80% of their full capacity and additional feeders would be necessary. Another 33 kV cable will also be laid to Elsies River.

Local Traders Support Cornwall TV Site

THE co-ordination of local radio retailers and the public in support of the B.B.C.'s case to erect a television transmitter on North Hessary Tor, Dartmoor, has been initiated by Metropolitan Distribution Ltd. The Minister of Housing is to hold an enquiry at Exeter on September 29 to hear objections to the transmitter station raised by the Dartmoor Preservation Society. The company's campaign is being sponsored by the Cornwall Federation of Chambers of Commerce.

Intrinsically Safe Apparatus

AT the end of the annual "Electrical Accidents" report, issued by the Factory Department of the Ministry of Labour and National Service, there appears a list of certificates issued by H.M. Chief Inspector of Factories, in respect of intrinsically safe and approved electrical apparatus for use in certain specified atmospheres. This has now been revised up to May 1953, and issued separately as Factory Form 931.

The method of certification must be carefully distinguished from that applied to flameproof apparatus.

£210 FINES FOR PURCHASE TAX OFFENCES

PLEADING guilty to seven joint charges of making false purchase tax returns relating to electric fires supplied for Nottingham Corporation houses, Mansfield Factors (Electrical Supplies) Ltd., were fined £70 and their managing director £140. Costs of 25 guineas were shared. Prosecution stated that the company sold the fires to sub-contractors, paid the tax and obtained it from the sub-contractors. By a special arrangement some 376 fires were supplied direct by the manufacturers to the sub-contractors without any invoices being made out by the accused.

The director was said to have explained that the invoices were deferred out of consideration for the contracting firm who might have to wait up to two years before accounts with the Corporation were settled. This was later denied by the Corporation. Mr. T. N. S. Roose, defending, pointed out there was no falsification — only omission — from returns of money paid later. Tax of £842 due, was paid subsequently.

Brush Explanation of Group's Policy

RECENT technical progress in the Brush Group was reviewed last week by Mr. Miles Beevor, the Managing Director, who succeeded the late Mr. Alan Good. Taking the electrical side of the Group first, he recalled that there are two factories located at Loughborough and Cardiff. During recent years when the engine companies were being added to the Group, there was some tendency to regard the chief function of the Loughborough factory as being to supply the electrical needs of the engine factories. Policy in this respect has now changed, and more emphasis is being placed on the Loughborough products not necessarily directly related to engine sales. In fact, the electrical side of the Group is being built up as a trading entity which will support itself without having to rely upon the sales of the engine companies.

The Group announced some little time ago that while it would continue to maintain friendly relations with the Associated British Engines group of companies, it had been decided that they should operate as entirely separate concerns. The occurrence of shared stands at certain exhibitions such as the Engineering and Marine is merely a reflection of the early booking necessary for such events.

Ventilating and Heating Exams.

NEXT year's examinations of the Institution of Heating and Ventilating Engineers will be held during April and May. Actual dates will be April 5 to 9 for Section A and May 20 to 22 for Section B. Application forms must be submitted before February 28. These are obtainable from the Institution's secretary but candidates who have not previously made application are reminded that they must submit proposal forms for membership. These must have been received by the secretary before December 31.

Marine Examinations

ANOTHER series of examination dates announced last weekend concern those for admission to the Institute of Marine Engineers. The common preliminary examination for students will be held between April 6 and 9, and October 5 and 8 next year; the associate membership exam. for graduates between April 26 and May 19; and the exams. for associate members from April 26 to May 20.

Relighting City's Trolleybus Routes

ALL main roads in Newcastle which carry trolley bus traffic are the subject of a street lighting project now being carried out by the city's Electricity and Transport Dept. Main feature of the installation is that the fittings have been fixed to the existing trolley bus stanchions —an obvious arrangement in the circumstances but not one considered ideal by lighting engineers. One of the problems in such a case is the countering of shock and vibration and this has been solved by the use of Metrovick's SO Fifty lantern, found to be eminently suitable. The accompanying illustration shows Barrack Rd. where 63 of these lanterns house 140 W sodium lamps.

TWO SPECIAL COURSES IN S.-EAST LONDON

THE department of electrical engineering at S.E. London Technical College has informed us of two courses which are to begin next month. The first is a course of about 30 weekly lectures on "Elements of Electric Lighting Practice" which begins on October 22. It is intended for installation engineers, showroom managers, builders and others requiring a basic knowledge of lighting practice. Lecturer will be Mr. G. V. McNeill and fee for the course is 30s. The second course will be on "Vector Analysis and Fundamental Electromagnetic Theory." Lecturer in this case will be Mr. E. R. Trendell, who will deliver about 26 talks each Wednesday, beginning on October 14. Fee is 24s. Applications for admission should be made to the Head of the Department, Mr. C. W. Robson, as soon as possible.

Glass Lighting Fittings on O.G.L.

FOLLOWING the removal of restrictions on the making and supply of cut glass, the Board of Trade has placed all imports of cut or decorated glassware on open general licence. Consequently the relevant schedule has been amended to include illuminating glassware of all kinds and all lighting appliances and fittings.

Sodium lamps along Barrack Road, Newcastle-on-Tyne

SPECIAL TARIFFS FOR CHURCHES & HALLS

ACTION taken by the Southern Electricity Board to cope with the special circumstances applicable to churches and meeting places of charitable and voluntary institutions, has been sanctioned by the area's Consultative Council. A new block tariff proposed by the Board applies to churches and other places of worship, scout huts, A.T.C. huts and similar places, church halls, village halls and women's institutes. As from the first meter reading after September 30 the new block tariff will provide for reduced lighting and space heating assessments of 80 units and 20 units per kVA instead of 160 units and 40 units, provided the premises are not attached to large establishments. It will also apply to other social and recreational halls if it is shown that consumption during the winter months is mainly outside the 7 a.m. to 7 p.m. period. As regards schools and homes, the Board states it is prepared to investigate the load characteristics of these places but could not accept the contention that consumption of electricity was outside peak hours.

The introduction of a special published tariff for village halls and similar places is also recommended by the Eastern Consultative Council. This follows representations made in that area by various charitable organisations for exemption from existing rates. The proposal is to be forwarded to the Area Board. This is considered an easier step than granting individual assessments for particular cases.

Welded Structures

A CONFERENCE to review existing knowledge and problems in the design and fabrication of welded steel structures, is to take place between Nov. 23 and 27, at the Institution of Civil Engineers. The conference is open to all who register as members with the joint hon. secretaries at the Institution, Gt. George St., S.W.1. Application may also be made to other bodies who have agreed to be co-sponsors, and these include the I.E.E., Mechanical Engineers, Institute of Welding, and 12 others. Registration fee is £2 10s.

Annual Dinner-Dance

WE note that the Electrical Trades' Commercial Travellers' Association are holding their annual dinner and dance at the Café Royal in Regent Street, W.1, on October 2. The programme, which includes dancing from 9.30 p.m., cabaret at 11.30 p.m. and a midnight buffet will close at 2 a.m. Tickets at 35s. each may be obtained from the hon. social secretary, Mr. H. Bowen, of 37 Penywern Road, S.W.5.

Parish Buys Its Street Lights

THE parish of Stogursey (Somerset) has decided to buy its street lighting from the S.W. Electricity Board. It was explained that the council has been perturbed at the high cost of the installation and were seeking economies. Expenditure on street lighting in the parish had risen from £39 in 1950, to £65 10s. this year.

Belfast Corporation Justifies Boiler Contract Action

AT the meeting last Thursday, Belfast Corporation Electricity Committee justified its decision, recently challenged in the High Courts, to place the contract, valued at £2,976,469, with Babcock & Wilcox Ltd. for boiler plant for the West power station. By 9 votes to 2, the Committee decided to record special consideration in the minutes in respect of the boiler plant. In affirming their previous decision, against advertising publicly for tenders, the Committee had taken cognizance of a further report from their consulting engineers which stated that it was essential that orders for the plant should be placed as soon as possible if there was to be any hope of it being installed and in operation by 1956-57.

At the meeting, letters of protest from the Chamber of Commerce and other bodies, were tabled. The Committee rejected by 9 votes to 4 an amendment calling for public advertising for tenders for the plant. A special meeting of the City Council is considering the Committee's decision this week.

NEWS IN BRIEF

Fraser and Borthwick Ltd., the Glasgow firm of electrical and mechanical engineers and contractors, celebrated their jubilee earlier this month.

E. K. Coles' exhibition of Thermovent heating equipment is touring the provinces. It will be in Belfast on September 24 and 25, Glasgow on October 7 and 8, Manchester on October 13 and 14, and Birmingham on October 19 and 20.

Over 300 employees, and their families, of Telcon went to Crawley New Town recently to inspect progress on the company's new metals factory.

Fifth annual students' social evening of Telcon took place at Greenwich Town Hall recently.

Durham was the venue of this year's sales conference of the Atlas Lighting Division of Thorn Electrical Industries Ltd.

National Coal Board university scholarships in mining engineering and allied subjects have been offered to 34 young men in the industry, and 34 boys outside it. Scholarships cover the cost of education and carry a maintenance allowance of up to £300 a year.

Safe driving awards have been presented to 35 drivers employed by the London Electricity Board. Winners had earned awards for ten years or more of safe driving.

Electric Supply News . . .

Cumberland

News of the work of the National Trust in introducing electricity to its farms in the Lake District was given at a local conference last week-end. Where these farms were situated at remote places at the head of the valleys, and it would not be economical to provide an electricity supply from the public mains, private plant is being installed. Already a pilot experiment has been made at Troutbeck Park Farm where a semi-automatic diesel generator has been installed at a cost of about £600. As this has been working well, approval in principle has now been given to the extension of the scheme to several other farms at the heads of valleys in Langdale, Eskdale and Borrowdale, for instance. It is admitted that the scheme is rather costly, but it is felt that these farmers should not be denied the benefits of mechanisation, while the other comforts which an electricity supply can bring will minimise any possibility of depopulation of the areas.

Northampton

The B.E.A.'s Hardingstone generating station takes more than the whole capacity of the River Neve through its cooling system at times, and its effects can be traced for approximately ten miles downstream, it is stated in the annual report of the Nene River Board. But the control measures adopted, appear adequate to keep the temperature within reasonable limits, it is added.

Northern Ireland

The recent reduction by the Electricity Board for Northern Ireland of the guarantee from 20% to 17% of the capital cost of the installation for new rural consumers has met with acceptance from farmers, and, as a result, development is going ahead faster than last year, we understand. So far, the Board are very satisfied with the response from the rural districts to this revised guarantee system. Farms are being connected up at the rate of over 1,000 per year.

North Wales

The reply from the Minister of Fuel and Power regarding complaints of slow progress in rural electrification was considered by the North Wales Rural District Councils' Association at its meeting last week. The Minister pointed out that an extra £1½ million would be allocated to the boards bringing the total allocation for next year to £7½ million. The Merseyside and North Wales Board's share is £150,000 for a period of eighteen months. That Board were developing eight sections per annum and it was proposed to increase the number to ten. Major E. K. Turnour, also a member of the Area Consultative Council, said that not all members of that council were agreeable to the extra capital being devoted to rural development. Some contended that capital would be better employed in the industrial areas because better value for the money would be received.

S.E. Scotland

An additional allocation of £60,000 for rural electrification in the period up to March 31, 1954, has been received by the South East Scotland Electricity Board, if was stated at the Area Consultative Council meeting last week. The allocations for the Board's four sub-areas are: Central, £25,000 (compared with £19,750); Fife, £61,000 (£30,054); Lothians, £40,000 (£30,665); and Southern, £115,000 (£100,000). Mr. J. M. Airlie, chairman of the Board, told the Council that the board had been allocated an additional £160,000 for development in the next eighteen months; £100,000 being for the year ending March 31, 1955. The allocation had come when the financial year was half over. He hoped that the Board would in future get to know exactly what it was allowed to spend at the right time.

South-West Scotland

Schemes for the reinforcement of supply in the eastern and southern parts of Rutherglen, estimated to cost £13,676 and £17,800 respectively, have been approved by the Southwest Scotland Electricity Board. The schemes provide for the establishment of new substations in Johnstone Drive, Bankhead Road and Cambuslang Road.

The Board has also approved two other schemes, the first, costing £14,254, for providing a supply of electricity to 251 new houses at Mains (East) V. Site, East Kilbride, and the second, to give a supply to the National Coal Board at Bedlay Colliery, Lanarkshire, where the load will ultimately reach 7,000 kVA.

LIGHTING SCHEMES

Billingham-on-Tees.—The U.D.C. is seeking loan sanction for £868 for improving lighting in Roseberry Road and £900 for similar work in Belasis Avenue.

Gt. Yarmouth.—T.C. is recommended to approve a scheme for re-lighting of the Marine Parade between Wellington Pier and Main Cross Road, at a cost of £4,330.

Pittenween.—T.C. has decided that mercury vapour lamps should be substituted for the present gas street lamps.

Rutherglen.—The town council has approved a four year plan for the extension of street lighting in the burgh at a cost of £6,594. Conversion to electric lighting will be effected in Mill Street, Fare Street, Cathcart Street, Mill Street, Chapel Street, Westnum Place, Rodger Drive and the areas with gas lighting adjacent to Main Street.

Skegness.—The Roads and Buildings Committee has recommended the council to confirm the conversion of street lighting to electricity.

Company Activities . . .

Associated Electrical Industries Ltd.

The Board propose that £8,870,596 be taken from reserves to be applied in paying up in full 8,870,596 unissued Ordinary shares, to be distributed on a one-for-one basis. This announcement has been made along with the statement that the interim dividend is again 7½ per cent. The new scrip distribution, which is intended to bring the issued Ordinary capital into better relation with the actual capital employed in the business, has been approved by the Treasury. The new shares will rank for the final dividend for 1953. The Board propose to take £6,104,730 from the Share Premium Account, £1,003,728 from Reserve for Increased Replacement Cost of Fixed Assets, £49,345 from E.P.T. Post-War Refund Suspense Account, £1,364,403 from other reserves and £348,393 from the profit and loss account balance. At the meeting on October 8, shareholders will be asked to approve a resolution increasing the capital to £28 million by the creation of 6 million Ordinary shares of £1 each and 4 million Unclassified shares of £1 each, the further 6 million £1 shares together with 3,129,404 Ordinary shares already authorised but unissued, making in all 9,129,404 shares, will be available for issue. Of that number, 8,870,596 will be credited as fully paid up, leaving a balance of 258,808 Ordinary shares for future issue.

Belliss and Morcom Ltd.

The turnover of this concern was maintained during the year ended March 31 but the higher costs were not passed on to customers owing to the highly competitive market, the directors state. The results for the year we noted last week. For economy and to increase potential turnover, a modern extension to the Ledsam Street Works is being built at a cost of about £250,000 and should be completed in 1954.

Morgan Crucible Co. Ltd.

The gross trading income for the year ended March 31 last compared favourably with that of the previous year, the reduction in profit being mainly due to the loss suffered by the new subsidiary, Morgan Refractories, Mr. P. Lindsay, the chairman, explains. But the directors are confident that this enterprise will eventually contribute to the group profit. With the build-up of unexecuted orders carried from the previous year, sales income was slightly greater than that of the previous record year. Without that build-up, a 20 per cent drop would have been experienced. Export sales reached a figure of 40 per cent of total sales income. A fall in the volume of sales must be expected, Mr. Lindsay warns, but it is hoped that there will be an improvement in the profitability of sections of the business which are in the early stages of development.

Year to Mar 31	£ Trading Profit	£ Net Profit*	% on Ord. Earn'd	% on Ord. Paid	Ord. Price High	Ord. Price Low
1949	1,357,319	517,032	34	12½	58/9	47/6
1950	1,310,626	461,305	30	12½	52/6	48/8
1951	1,738,184	533,738	37	12½	57/6	46/9
1952	2,290,410	770,971	55	12½	49/-	42/-
1953	1,867,285	608,215	41	12½	50/6	44/9

*Available for the parent company.

Newton Brothers (Derby) Ltd.

The accounts for the year ended March 31 last, bear witness of another successful year's trading, in which defence contracts no doubt formed a valuable part. Even so, the increase in the trading profit over the past few years, shown in our accompanying table, is quite remarkable. In the present accounts, the sum of £26,338 has been placed to general reserve, £15,000 to reserve for replacement of fixed assets and equipment, and £15,000 for research and development reserve, leaving £30,143 carried forward.

Year to Mar.31	£ Trading Profit	£ Net Profit	% on Ord. Earn'd	% on Ord. Paid	Ord. Price High	Ord. Price Low
1949	81,974	28,893	66	25*	4/1	3/1
1950	84,421	43,750	50	15	4/11	3/-
1951	115,007	60,935	73	13⅛	6/1	4/8
1952	150,070	43,690	58	16½	5/6	4/1
1953	181,625	74,537	49	10†	3/-	2/3

* Plus 100% capital bonus.
† Plus 75% capital bonus.

Ransome and Marles Bearing Co.

With a final dividend of 12½ per cent and a bonus of 5 per cent, the total distribution for the year ended June 30 last is 25 per cent, the same as for the previous year. The group profit for the year is £1,004,338 compared with £1,055,938 for the previous twelve months, and the net profit of the holding company amounts to £301,928 (£302,604).

Vent-Axia Ltd.

The directors have made an offer for the issued share capital of Axia Fans Ltd., consisting of £3,500 6% Preference stock and £41,500 Ordinary stock. The purchase price of £92,000 is to be satisfied as to £50,000 in cash with the balance in the form of the allotment of £5,600 Ordinary stock of Vent-Axia Ltd., which has been taken for the purpose as worth 7s. 6d. per 1s. unit. The authorised capital is to be increased to £240,000, and composed of £120,000 Ordinary stock or shares and £120,000 6½% £1 Cumulative Redeemable Preference shares.

Dividends Declared

Aberdare Cables (Holdings).—Interim of 5% (*10%*) on doubled capital.

Albright & Wilson.—Interim of 5% (*same*).

C. A. Parsons & Co.—Interim of 6¼% (*5%*).

Reyrolle & Co. Ltd.—Interim Ordinary dividend of 6¼% (*5%*).

Commercial Information

CONTRACTS OPEN

HOME

Sept. 18.—Harrow U.D.C. Supply and installation of 196 140 W sodium lamps, lanterns and control gear to group A on various roads. J. H. Melville Richards, Engineer, Council Offices, Uxbridge Rd., Stanmore. Deposit £2.

Sept. 18.—Lancashire. Supply of sundry domestic and other appliances. Applications by above date to County Architect, County Hall, Preston. (See Sept. 10 issue.)

Sept. 19.—Bridgnorth T.C. Supply and erection of 54 cast-iron class B lighting standards with 100 W tungsten lamps and other equipment for roads on the Grove estate. Borough Surveyor, College House. Deposit £2 2s.

Sept. 19.—Enniscorthy (Eire). Installation of electrically operated kitchen equipment plus wiring and lighting installation at Mental Hospital. N. Mathews, Consulting Engineer, 42 Fitzwilliam Place, Dublin. Deposit £10 10s.

Sept. 21—Easthampstead (Berks) R.D.C. Installation of wiring and fittings in 28 houses on Roebuck estate, Binfield. Engineer and Surveyor, Council Offices, Church Rd., Bracknell. Deposit £1 1s.

Sept. 21.—Fifeshire. Electrical work in 20 houses at Guardbridge. Robert Galbraith and Lawson, chart. quantity surveyors, 21 Crossgate, Cupar.

Sept. 21.—Haverfordwest T.C. Supply and erection of 60 h.p. mercury vapour lamps, concrete and steel columns and wall brackets, along 1¼ miles of trunk roads A.40 and A.4076. Borough Surveyor, 9 Victoria Place. Deposit £2 2s. (See Sept. 3 issue.)

Sept. 21.—Hepton (Yorks) R.D.C. Electrical work in erection of 24 flats at Heptonstall and Wadsworth. N. H. Singer, architect, District Bank Chambers, Hebden Bridge. Deposit £2 2s.

Sept. 23.—Newcastle - on - Tyne T.C. Supply and installation of four electric passenger lifts in multi-storey blocks of flats on Hindhaugh St. site. City Architect, 18 Cloth Market.

Sept. 23.—Ryton (Dur.) U.D.C. Installation of lighting and heating in 50 houses on Park Field North estate. Surveyor, Council Offices.

Sept. 23.—Swansea T.C. Applications invited from contractors wishing to tender for electrical installation at swimming baths, St. Helens Rd. Borough Architect, The Guildhall. Deposit £2. (See Sept. 3 issue.)

Sept. 23—Wembley T.C. Installation of flashing beacons at 39 pedestrian crossings. Borough Treasurer, Town Hall. Deposit £1 1s.

Sept. 24.—Ashington U.D.C. Electrical installation in 64 houses in Darnley Rd. M. Jameson, surveyor, Council Offices.

Sept. 24.—Clutton R.D.C. Electrical installation in 20 houses at High Littleton and 19 at Farmborough. J. Barwick, clerk to Council, Council Offices, Temple Cloud, nr. Bristol Deposit £2 2s.

Sept. 24.—Co. Down. Electrical installation at Ballylesson primary school. Architects are Ostick and Williams, 12-14 Corporation Street, Belfast. Deposit £3 3s.

Sept. 28.—Stockton-on-Tees T.C. Electrical installation at Roseworth junior school. Borough Architect, 28 The Square. Deposit £1 1s.

Sept. 28.—West Riding. Rewiring of installation at Batley Healey primary school. County Architect, "Bishopgarth," Westfield Rd., Wakefield.

Sept. 30.—East Riding. Installation of electrical services at Driffield secondary school. County Architect, County Hall, Beverley.

Sept. 30—Manchester T.C. Cable, concrete and steel standards, lanterns, mantles and time switches included in list of supplies required during 1954. Documents from City Surveyor (Room 329), Town Hall.

Sept. 30—N. Ireland. Electrical, installation in administrative buildings and nurses' home, and rewiring in West House, at Fever Hospital, Purdysburn. Consulting engineers are F. W. Parkinson and Partners, 6 Murray St., Belfast. Deposit £3 3s.

Oct. 1.—Ashton - in - Makerfield U.D.C. Supply of 28 concrete columns and lanterns for mercury discharge lighting for Old Rd. scheme. Surveyor, Town Hall.

Oct. 1.—Tyrone. Complete electrical installation in Tyrone and Fermanagh Hospital, Omagh. N.I. Hospital Authority's Chief Engineer, 104 University St., Belfast. Deposit £3 3s.

Oct. 2—Walthamstow B.C. Supply of 255 sets of 140 W sodium discharge lighting and electrical equipment, for Forest Rd., Chingford Rd., and Hoe St. Borough Architect, Engineer and Surveyor, Town Hall, E.17. Deposit £2 2s. (Advertised in this issue.)

Oct. 5.—Manchester T.C. Electrical installation at Moss Nook secondary school, Wythenshawe. City Architect, Town Hall. Deposit £1 1s. (See Aug. 27 issue.)

Oct. 10.—Haslemere U.D.C. Supply and erection of duplicate pumps together with electric motors and control gear at Shottermill sewage works. C. A. Best, Engineer and Surveyor, Council Offices, Museum Hill.

Oct. 12.—Halstead R.D.C. Supply of two sets of electrically-driven vertical spindle borehole type pumps and two vertical electrically - driven booster pumps plus all ancillary equipment. Engineers, John Taylor and Sons, Artillery House, Artillery Row, Victoria St., Westminster. Deposit £5.

Oct. 17.—Tyrone. Electrical installation in new buildings on Goolnafranky estate, Cookstown, at a grammar school, secondary intermediate school and dining-room. Chief Education Officer, Education Offices, Omagh. Deposit £3 3s.

No date stated.—Bucks. Supply of electrical measuring instruments, resistances, laboratory equipment including batteries, installation equipment, cables, and radio equipment for High Wycombe College of Further Education. Applications to D. E. Cooke, Chief Education Officer, County Offices, Aylesbury. (Advertised in this issue.)

OVERSEAS

*Details of items marked * may be obtained on application to the Board of Trade, Lacon House, Theobalds Road, W.C.1, quoting reference.*

Oct. 1.—South Africa. Tenders (C. 6622) invited for 4,000 ft 0·0225 sq in. v.i.r.c.c.s.w.a.s. 660 V twin cable, and 20,000 ft 7/0·036 v.i.r.l.c.s.w.a.s. 250 V twin cable, and 10,000 yd copper wire for Stores Dept. of S. African Railways. Chairman of Tender Board, P.O. Box 7784, Johannesburg. B.o.T. (Ref.: ESB 3929/53)*.

Oct. 5.—Pakistan. Dept. of Supply and Development invites tenders (DS/E/2387/2388/P/2) for supply of 1,000 ft ·0225 sq in. 660 V and six miles of ·0225 sq. in. 11 kV, three-core PILC-WA cable. Director General of Dept., Sadanghat, Chittagong. B.o.T. (Ref.: ESB 3699/53)*.

Oct. 6.—Egypt. Supply of 170 3-phase transformers 10,500 V h.t., 380/220 V l.t., variable capacities 150 to 500 kVA. Documents from Chief Inspecting Engr., Egyptian Govt., 41 Tothill St., S.W.1. Deposit £2 1s. (See Sept. 10 issue.)

Oct. 13.—U.S.A. U.S. Bureau of Reclamation invites tenders (DS4024) for supply of switchboard extension for Lovell substation. Tenders to Bureau at Building 53, Denver Federal Centre, Denver, Colorado. B.o.T. (Ref.: ESB 3820/53)*.

Oct. 15.—India. Supply of sixteen 500 kVA transformers and four 250 kVA transformers for Bombay Municipality. B.o.T. (Ref.: ESB 2887/53).*

Oct. 17.—Egypt. Installation of electric pumping stations and transformers, including auxiliary machinery, motors, switches, pumps, instruments, transformers for 33/66 kV 50 c/s at six locations. Documents from Chief Inspecting Engineer, 41 Tothill St., London S.W.1, at £E10.

Oct. 22.—New Zealand. Supply of 25,000 6 V, metal filament switchboard lamps under tender No. P. and T. 150/6417, for Post and Telegraph Dept., Wellington. B.o.T. (Ref.: ESB 3426/53)*.

Oct. 22.—South Africa. Tender and Supplies Board, 271 Visagie St., Pretoria, invites tenders (S.O. 7654) for test equipment for use of Div. of Civil Aviation with radio beacons of frequency range 200-400 kc/s, 250 W and 2 kW power output B.o.T. (Ref.: ESB 4016/53)*.

Nov. 20.—Australia. Supply of twelve 11,000 V 3-phase 300 A outdoor type metalclad oil-immersed ring main tee off fuse switchgear with isolators and fuse switches, and 76 H.RC fuses. Documents from Dept. of Electricity, Kelvin House, Adelaide St., Brisbane, 10s. 6d. each. B.o.T. (Ref.: ESB 2850/53).*

Nov. 12.—Australia. Supply of ten three-pole relays for overall protection of 33 kV feeders with directly associated and connected power transformers. Feeders will operate at either 33,000 V or 22,000 V, and have a maximum route length of 15 miles. Sydney C.C., Queen Victoria Building, George St., Sydney. B.o.T. (Ref.: ESB 4017/53)*.

CONTRACTS PLACED

Billingham-on-Tees U.D.C. Supply of transformers for Furness pumping station, N.E. Electricity Board, £2,050.

B.E.A. Two 550,000 lb/hr boilers for S. Denes, International Combustion, Ltd., two 60,000 kW turbo-generators and auxiliary apparatus for same, Metropolitan-Vickers Electrical Co., Ltd., and condensing and feed heating plants for two 60,000 kW turbo-generators for same, Vickers-Armstrongs, Ltd.; one 72 MVA transformer and one 6 MVA transformer at Nottingham, Metropolitan-Vickers Electrical Co., Ltd.; 3·3 kV auxiliary switchgear at Hams Hall C, A. Reyrolle & Co., Ltd.; one 515,000 lb/hr boiler at Meaford B, Babcock & Wilcox, Ltd.; Condensing and feed heating plant for one turbo-generator set at Uskmouth, Vickers-Amstrongs, Ltd.; Generator transformer at Ferrybridge B, C. A. Parsons & Co., Ltd., and two 10 MVA transformers at same, Fuller Electrical and Manufacturing Co., Ltd.; 132 kV 2,500 MVA switchgear at Andover substation, British Thomson-Houston Co., Ltd.; 132 kV switchgear at Pyle substation, English Electric Co., Ltd; and 132 kV 2,500 MVA switchgear at Creyke Beck sub-station, A. Reyrolle & Co., Ltd.

Your Queries — Answered

"Dimma," three-way dimmer switches, makers of? L.B.—Electrothermal Eng. Co., Ltd., 270 Neville Rd., E.7. (23907)

Waffle cooker, electric, makers of? M.A.—S.L.R. Electric Ltd., 58 South Harrow Viaduct, South Harrow. (23919)

Appliance connectors, rubber, makers of? G.D.—British Insulated Callenders Cables Ltd., Bical House, Bloomsbury St., W.C.1; Reliance Electric Wire Co., Ltd., Fingal Works, Staffa Rd., E.10. (23932)

"Power Master" refrigerators, address for service? L.B.—32 High Cross Rd., Tottenham, N.17. (23946)

"Ajax" insulated staples, makers of? C.C.—Joseph Nichols Ltd., Cheapside, Birmingham 12. (23960)

Bulwark Electrical Co., address of? A.W.—Bulwark Electrical Co. (Liverpool), Ltd., West Toxteth Hall, 2 South Hill Rd., Liverpool 8. (23976)

"Q. and S., Sawmaster," makers of? C.C.—Qualters and Smith Bros., Ltd., Crookes St., Barnsley. (23989)

The above are selected from questions we have answered this week. If you have a query, send it to us.

FURTHER ANSWER

Fly killing device which uses the heat of an ordinary lamp, makers of? S.E.—Associated Fumigators Ltd., 114 Victoria Dock Rd., E.16 make a volatiser which fits above an ordinary lamp. (23780)

TRADE NOTES

BEAMA Contract Price Adjustment Formulae. *For Electrical Machinery and Equipment.* For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour at Sept. 12, 1953, shall be deemed to be 141s. 6d. (*b*) "Cost of Material"—the index figure for Materials used in the Electrical Machinery Industry published in the Board of Trade Journal on Sept. 12, 1953, is 149·7.

For Turbo-Generating and Allied Plant. For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour at Sept. 12, 1953, shall be deemed to be 141s. 6d. (*b*) "Cost of Material"—the index figures published in the Board of Trade Journal on Sept. 12, 1953, are: Materials used in Mechanical Engineering Industries 143·2, "Blast Furnaces and Iron and Steel Melting and Rolling (40 and 41)"—144·3. The price of brass condenser tubes ¾ in. o.d., 18 s.w.g. published in The Metal Bulletin on Sept. 11, 1953, is 3s. 6¼d.

For outstanding Contracts covered by the B.o.T. Intermediate Products Index. For purposes of calculating variations in: (*a*) "Rates of pay"—the rate of pay for adult male labour at Sept. 12, 1953, shall be deemed to be 141s. 6d. (*b*) "Cost of Material"—the index figure for Intermediate Products published in the Board of Trade journal on Sept. 12, 1953, is 354·9.

Change of Address. As from Sept. 19, the London address of Clarke, Chapman & Co., Ltd., will be Dunster House, Mark Lane, E.C.3. Telephone: Mincing Lane 8345.

London Service Depot. The English Electric Co., Ltd., have opened a London Service depot in Belsize Crescent, Hampstead. It has workshops for both television and domestic appliance servicing.

Tungsten Ores. As from September 16 the price of Wolframite was reduced from 327/6d. to 310/- per ton, and for Scheelite from 312/6d. to 300/- per ton delivered.

Selling Agents. We are informed that Oliver Pell Control, Ltd., Cambridge Row, Burrage Rd., Woolwich, S.E.18, have become the sole selling agents for Besson and Robinson Ltd., who have developed relays, delay switches and tuning devices.

PRICE OF CABLE METALS AND OTHER MATERIALS
(at Tuesday night)

	£ s. d.	New York price
COPPER, electrolytic	227½-230½	232 0 0
,, (3 months)	213-213½	—
LEAD, good soft pig (foreign)... ...	90-90½	112 0 0
TIN (99·99·76%) (Cash)	597-600	—
,, ,, (3 months)	590-592½	—
ALUMINIUM, commercial purity (del.)	150 0 0	—
ZINC	67½-67¾	80 0 0
ARMOURING:		
Galv. Steel Wire (0·104 in.) ...	50 10 0	—
Mild Steel Tape (0·04 in.)... ...	40 0 0	—

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Electromatic Bar Installations, Ltd., London, S.W.4. Last day for receiving proofs in respect of intended dividends, Sept. 24. Liquidator is A. T. Eaves, 47 Mosley St., Manchester 2.

Ingham and Owen, Ltd., Manchester. Liquidator, A. T. Eaves of 47 Mosley St., Manchester, released as from Aug. 17.

Jay-Vee Engineering Products, Ltd., Colchester. J. B. Sanderson, liquidator, 17 Museum St., Ipswich, released as from July 3.

S. and T. Martin, Ltd., London W.C.2. Sept. 23 is last day for receiving proofs in respect of intended dividends. Liquidator is F. M. Collins, Official Receiver, Inveresk House, Strand, W.C.2.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Buzzaway. 720,098. Class 11. Electric lamps. Crompton Parkinson Ltd., Netherfield Rd., Guiseley, near Leeds.

Conglass. 717,884. Class 17. Insulators, etc. Connollys (Blackley) Ltd., Blackley Vale Mills, Blackley, Manchester 9.

Flexmaster in design. 719,380. Class 7. Motor-driven flexible-shaft tools and rotary grinding wheels, etc. Flexible Drives (Gilmans) Ltd., 195 High St., Smethwick, Birmingham 41.

Grapstop. 717,417. Class 9. Installations and devices for the prevention of theft, burglar alarm systems, etc. Halland Industrial Distributors Ltd., 34 Victoria St., S.W.1.

Mimco. 718,063. Class 9. Scientific, nautical, surveying and electrical apparatus and instruments, etc. Marconi International Marine Communications Co. Ltd., 336 Strand, W.C.2.

BANKRUPTCY ACTS

First Meeting

Blackwood. Frederick B Williams, electrical retailer and contractor, trading at 123B High St, Blackwood, Mon. Meeting at Official Receiver's Office, 34 Park Place, Cardiff, on Sept. 21 at 11.30 a.m., and public examination at County Court, Blackwood Rd., Blackwood, on Oct. 15 at 2.30 p.m.

Release of Trustee

Hereford. Philip Thomas, radio and electrical engineer, trading at 4 New St., Ledbury. Trustee was R. K. Clark, 37 Temple St., Birmingham 2

Southampton. Lancelot E. Lawson, trading as Lawson's Radio at 1 Northam Rd., Six Dials, Southampton. Trustee was N. G. Randall, Incorp. Acc., of 100 Park St., Grosvenor Sq., London W.1.

Public Examination

Croydon. Ralph W. Scott, electrician trading as Bromley Ignition Co. at 44 Market Parade, Rye Lane, Peckham, S.E.15. Public exam. at County Court, Scarbrook Rd., Croydon, on Nov. 5 at 11 a.m. First meeting took place yesterday (Wed.).

Intended Dividends

Huddersfield. Albert E. Beaumont, electrical and radio engineer trading at 216 Manchester Rd., Thornton Lodge, Huddersfield. Last day for receiving proofs, Sept. 23. Trustee is W. H. Meredith, Official Receiver, 20 North Parade, Bradford.

Dividends

Windsor. Kenneth J. Ward, electrical contractor, trading at "Howard," Trusthorpe Rd., Sutton-on-Sea, Lincs. First and final dividends of 7½d. in £ payable at office of Official Receiver, 58-61 York Terrace, Regents Park, London N.W.1 on Tuesday, Sept. 22.

BUSINESS PROSPECTS

HOME

Aberystwyth T.C. Tenders expected to be invited soon for erection of 86 houses on Penybont West site.

Belfast. Ministry of Commerce is to obtain tenders soon for first of 16 factories planned in development of 34 acres of land at Carnmoney.

Birmingham. S. Court and Co., Ltd., 17 New Summer St., are planning to build new premises adjoining.

Blandford Forum (Dev.) T.C. Tenders may soon be sought for construction of 47 houses in district.

Bristol. Application to be made to borrow £16,450 for erection of river police station at The Grove, Queen Square.

Burnley T.C. Infants' school at Brunshaw and reorganisation of accommodation at Municipal College to be included in next year's building programme.

Buxton T.C. Plans to be prepared and tenders invited for erection of 26 terrace-type houses on Victoria Park (3) site.

Chesterfield. Plans prepared for new building at Tube works, Derby Rd., for Chesterfield Tube Co., Ltd.

Dagenham T.C. Erection of 38 houses and 18 bungalows in Padnall and Sheepcotes Roads. Borough Engineer and Surveyor, Civic Centre.

Dartford. Extensions to factory in Watling St. proposed by J. W. Jones and Co., Ltd. Also erection of two-storey offices, workshops and stores is planned by E. G. Porter and Sons, Ltd., in Green St. Dartford Paper Mills, Ltd., have plans for erection of new premises.

Durham. Renewal of electrical installations being planned for Chopwell West county school, £1,400; High Felling county and modern schools, £1,100; Felling Falla Park Rd. county school, £1,450; New Penshaw county school, £1,400; Springwell county school, £1,000; and three others totalling £920.

Gloucester. Reconstruction work is planned by Hatherway Works, Ltd.

Great Yarmouth T.C. Tenders may soon be invited for erection of flats and maisonnettes in Middlegate St. It is proposed also to build old persons' bungalows near Town Hall Rd.

Hainault (Essex). M. M. F Wingate, 231 Strand, London W.C.2, is architect for factory on industrial estate for Ladd and King.

Halstead (Essex). Erection of 27 houses at Earls Colne. H. E. P. Stokes, clerk, Council Offices, Mount Hill.

Harrow U.D.C. Erection of 44 dwellings at Stonegrove and 31 in Latimer Gdns. J. H. Melville Richards, Engineer and Surveyor, Council Offices, Uxbridge Rd., Stanmore, Middlx.

Hartlepool. Newrick and Blackbell, John St., Sunderland, are architects for factory alterations planned by John B. Pallin, Ltd.

Inverness. Dean of Guild Court has approved plans for re-erection of and alteration to shops in Church St., for F. A. Cameron, 11 Church St.

Isle of Ely. Construction of first part of Wisbech College of Further Education. County Architect, County Hall, March.

Lincolnshire. Work expected to start soon on erection of £90,000 secondary school at Brigg. County Architect, Lincoln.

Minehead (Som.). Boot and shoe factory to be built for C. and J. Clark of Street.

Newcastle-on-Tyne T.C. It is proposed to build a permanent depot, surveyor's office etc. on Iris Brickfield estate at a cost of about £12,000.

Northampton. Heathfield Way is the site for factory for Leather and Ferrersflex Components, Ltd., of Graveley St., Rushdean.

North Riding. Architects for proposed Thirsk grammar school are Leathart, Son and Tingay, 49 Welbeck St., London W.1. First instalment is in reserve list for next year's building programme.

Oswaldtwistle (Lancs.) U.D.C. Construction of 35 houses on Thwaites Rd. site. T. D. Manning, Engineer and Surveyor, Town Hall.

Padiham (Lancs.) U.D.C. Application to be made to borrow £27,588 for erection of 24 bungalows on St. John's Rd. estate.

Plymouth T.C. Layout approved for 123 houses on Barne Bardon estate, St. Budeaux, and 280 at Manadon Valley. Also erection of (*a*) catering instruction annexe at Technical College of Housecraft, (*b*) new central library, and (*c*) 72 flats in Pembroke St. H J. W. Stirling, City Architect, Seymour Road.

Redcar T.C. Erection of 80 houses on Lakes estate. Borough Engineer, Municipal Buildings.

Sheffield T.C. Oxley and Bussey, 91 Pinstone St., will probably be appointed architects for erection of 69 houses on various sites.

Sittingbourne (Kent) U.D.C. Construction of 32 houses on Canterbury Rd. estate. Engineer and Surveyor, Council Offices, High Street.

Southport T.C. It is proposed to build 256 houses, maisonnettes and flats and six shops on site near Emanuel Rd.

Southwell (Notts) R.D.C. Erection of 20 dwellings in Alexander Rd. S. Cooper, council's surveyor, 8 Westgate.

Spennymoor (Dur.). N.E. Housing Assoc. is to spend £2,241 installing electricity in 106 houses served by gas.

Stockport T.C. Plans in hand for construction of old persons' home on Brimmington estate. Cost estimated at £36,000.

Stockton-on-Tees T.C. Plans approved for eight shops with flats in Redhill Rd., Roseworth. Also a junior school is proposed for same area. Further 26 houses to be built in Roseneath Ave.

Stoke-on-Trent T.C. Approval received for work at Central Museum building at Hanley and for erection of civic art gallery on Bell Pottery site.

Strood (Kent) R.D.C. Construction of 20 houses in Sole St., Cobham. Engineer and Surveyor, Council Offices, Frindsbury Hill.

Surbiton (Surrey). Express Tools, Ltd., 21 Berrylands Rd., propose to erect factory in Roebuck Rd.

Toddington (Bed.). J. B. F. Cowper, 39 Gordon Sq., London, W.C.I, is architect for laboratories at Cheshunt Experimental Station.

Wakefield. Plans in hand for extension to factory at Victoria Works, Benjamin St., for C. S. Leah.

OVERSEAS

U.S.A. Representation of U.K. manufacturers of domestic electrical appliances being sought by Mr. Stewart C. Wright, 3241 Kentucky Ave., Minneapolis 16.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, London, W.C.2.

Ace Electrical Supplies (Manchester), Ltd. Electrical engineers, wireless, electronic and mechanical engineers, etc. Cap.: £1,000. Dirs.: M. H. Ashdown and Sylvia Ashdown, 24 Agden Park Lane, Lymm, Cheshire.

Braithwaite, Court and Co., Ltd. Technical publications consultants to the aeronautical, engineering, motor, electronics, electrical and allied industries, etc. Cap.: £1,000. Dirs.: W. J. Court, Byways, Hopfield Ave., Byfleet, Weybridge, Surrey; and H. E. Dacre-Braithwaite, 61 Albert Drive, Sheerwater, Woking, Surrey.

P. H. Carlow, Ltd., 47 High St., Silsoe, Beds. Manufacturers of and dealers in electrical and mechanical apparatus and accessories, in particular wireless sets, gramophones, etc. Cap.: £100. Dirs.: to be appointed by subs. Subs.: P. H. Carlow and Mrs. F. M. Carlow, 47 High St., Silsoe, Beds.

Charles Kendall and Partners, Ltd., 7 Albert Court, Kensington Gore, S.W.7. To acquire business, undertaking and assets of Charles Kendall and Partners (Investments), Ltd., mechanical, electrical and general engineers, etc. Cap.: £50,000. Dirs.: Capt. C. E. Kendall, Col. T. W. Pragnell, G. E. Peck, Charity M. Kendall, Col. A. N. S. Corbett, J. M. Kendall and Field Marshal Sir Claude Auchinlech.

Pennine Construction Co., Ltd. To construct and control railways, tramways, gas and electricity works, sewage and drainage works; civil, mechanical, electrical and general engineers, etc. Cap.: £5,000. Dirs.: not named. Subs.: D. Spencer, 20 Queen St., Paddock, Huddersfield; A. McDonagh, 17 Spring St., Huddersfield.

MEETINGS TO NOTE

THURSDAY, SEPT. 17

INSTN. OF ELECTRONICS.—"Semi-Conductors." J. S. Blakemore. Royal Soc. of Arts, W.C.2, 7.30 p.m.

A.S.E.E. (Portsmouth Branch).—"Association Affairs." E. A. Bromfield. Air Balloon, Portsmouth, 7.15 p.m.

A.S.E.E. (Kent Branch).—"Vee Belt Drives." J. H. Cleator. County Hotel, Canterbury, 8 p.m.

WEDNESDAY, SEPT. 23

E.A.W. (London). "Heating and Insulation in the Home." A. C. Hazel of Hurseal, Ltd., 35 Grosvenor Place, S.W.1, 2.15 p.m.

THURSDAY, SEPT. 24

I.E.S. (Nottingham).—Chairman's induction. E. Midlands Elect. Board, Smithy Row, 6 p.m.

INCORP. PLANT ENGRS. (Sheffield). "Electrical Factory Regulations." H.M. Factory Inspector. Grand Hotel, 7.30 p.m.

EXHIBITION DIARY

Welsh Industries Fair. Taking place at Sophia Gdns., Cardiff, between Sept. 9 and 19.

Nursing. 38th Annual Exhbn. opens at Seymour Hall, London W.1, on Oct. 12 and closes on Oct. 16.

PYE LIMITED

Continued Progress

THE 24th annual general meeting of Pye Ltd. was held on September 16 in London.

Mr. C. O. Stanley, C.B.E., chairman of the company, presided and, in the course of his speech said:—

Some people have written and asked my opinion on the commercial television dispute, but being a member of the Television Advisory Committee, I am not allowed to make any statement meantime. However, as soon as I am permitted, I will be delighted to state my personal feelings on this quite frankly.

Other letters have dealt with purchase tax and the credit stringency that restricts our export sales. I can add little to what has already been said in the report on the question of purchase tax, but there is one point that ought to be considered by the Government at the earliest possible moment. In our industry from the very earliest stage in production, a television or radio set is identified by a number, by which it can be traced throughout its life, and in this respect it differs from most forms of bulk merchandise. The burden imposed on our retailers when a reduction in purchase tax occurs could be avoided by an early decision by the Government to allow rebates of purchase tax on identifiable goods held in stock by retailers at the time of reduction.

We have told you that the export market is becoming increasingly difficult, but in spite of this we have taken steps to increase our sales by making a special effort in this field during the present year. Our export organisation has established its contacts in fresh countries, and it is our intention this year to send several of our executives abroad to promote sales, and to obtain information that will help us to exploit the overseas market more fully.

Gramophone Record Business

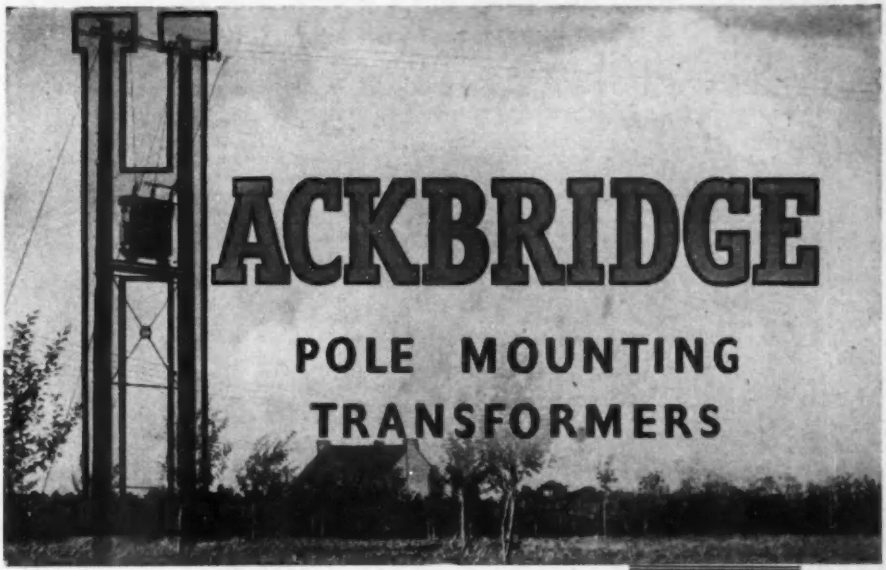
For a number of years your company has wished to have an interest in the gramophone record business. We are at this moment actively planning to enter this new field of manufacture and selling, and we hope to be able to make a definite announcement in the very near future.

Our new television industrial camera is now in production, and the first models will be going to overseas customers within a very short time. Already it is clear that all over the world there is a large demand for this product.

After making full allowance for the reductions made last year in Purchase and Income Tax, we have calculated that out of every 20s. we receive for radio and television sets sold, no less than 7s. 2d. is taken by the Government in taxation of one form or another, and only 4d. is left. Out of this 4d. we have to pay dividends to shareholders. Only the small sum remaining is available for future expansion and the increased cost of replacing capital assets. For this reason we have from time to time to raise fresh capital.

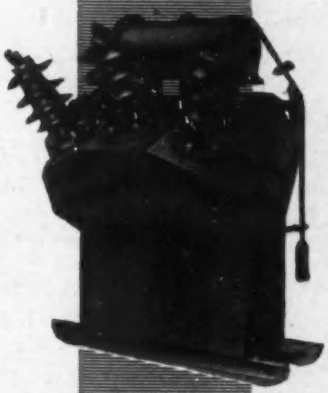
In practically every section of the organisation production efficiency has been improved, business has been extended, and profits have been made. For the first five months of this year, our turnover has been larger than during the same months in any previous year. Nobody can tell whether this progress will continue without interruption. Despite the costs of expansion, we must remember that the television market has only just begun in this country and has an enormous future. That alone should ensure the success of the company for many years to come.

The report was adopted.



HACKBRIDGE pole mounting transformers are used extensively in many of the world's largest distribution systems and the outstanding performance of the many thousands of these units installed during a period of over 25 years emphasises the supreme reliability of Hackbridge Transformers for this type of service.

Send for publication D.B.2.

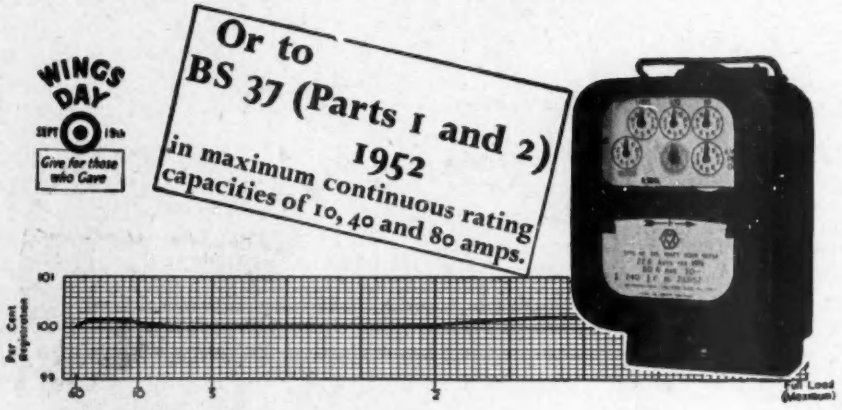


RIGHT: A 50 kVA 33/11 kV. three phase Hackbridge transformer for pole platform mounting.

HACKBRIDGE AND HEWITTIC ELECTRIC CO., LIMITED
WALTON-ON-THAMES - SURREY - ENGLAND
Telephone: Walton-on-Thames 760 (8 lines) Telegrams: "Electric, Walton-on-Thames"

Metrovick Type NF Meters

Available either to
BS 37—1937
in long range capacities of
2½, 5, 10, 25 and 50 amps.
Per cent Registration
99
0 5 10 20 50 100 200
Per cent Full Load



In designing the Type NF meter Metrovick engineers anticipated the requirements of the 1952 specification, consequently the two patterns are fundamentally similar.

METROPOLITAN-VICKERS ELECTRICAL CO. LTD., TRAFFORD PARK, MANCHESTER 17
Member of the A.E.I. group of companies

METROVICK *equipment for meticulous metering*

G/A201

CLASSIFIED ADVERTISEMENTS

OFFICIAL TENDERS AND APPOINTMENTS

WORK WANTED WANTED · FOR SALE

Those wishing to advertise in these pages should send the text to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London W.C.2, before 10 a.m. on TUESDAY of week of issue. Official Displayed Advertisements are charged at 42s. per inch, and all other classified advertisements at 3s. per line. Situations Wanted will be published four times for twice the single insertion rate. Fee for Box No. and postage on replies is 2s.

TENDERS INVITED

BUCKINGHAMSHIRE EDUCATION COMMITTEE

TENDERS are invited for supply of the following classes of equipment to the High Wycombe College of Further Education—

1. Electrical Measuring Instruments.
2. Electrical Resistances.
3. Radio Equipment.
4. Electrical Laboratory Equipment including Batteries.
5. Electrical Installation Equipment.
6. Electrical Cables.

Applications for tender forms should be made to me immediately. Firms interested should indicate the class(es) of equipment for which they wish to tender.

D. E. COOKE,
Chief Education Officer.

County Offices,
Aylesbury. (F 105)

BOROUGH OF WALTHAMSTOW

STREET LIGHTING EQUIPMENT
Forest Road, Chingford Road and Hoe Street

TENDERS are invited for the supply and delivery of 255 sets of 140-W sodium discharge lighting and electrical equipment.

Forms of tender, bills of quantities, etc., may be obtained from the Borough Architect, Engineer and Surveyor, Town Hall, Walthamstow, E.17, upon a payment of two guineas, which will be returned upon receipt of a bona fide tender.

Tenders in the envelopes provided must be delivered by post only, to the undersigned not later than 12 noon on Friday, October 2, 1953, and no tender the envelope of which bears any name or other distinguishing matter or mark indicating the identity of the sender will be considered.

The Corporation do not bind themselves to accept the lowest or any tender and may accept orders for the whole or any part of the schedule.

G. A. BLAKELEY,
Town Clerk.

The Town Hall,
Walthamstow, E.17.
September 7, 1953. (F 155)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18-64, or a woman aged 18-59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

BRITISH ELECTRICITY AUTHORITY

South Eastern Division

BRIGHTON "B" POWER STATION.
ASSISTANT ENGINEER (MECHANICAL INSPECTING)
Turbine House

THE successful applicant will be responsible for the inspection of mechanical plant, assessing extent of work and preparation of reports on defective plant and maintenance of records. National Joint Board conditions of service and salary, Class "J", Grade 11, £639 per annum.—Applications giving details of education, present position, experience, etc., should be received by the Station Superintendent, Brighton Power Station, Portslade-by-Sea, Sussex, not later than September 26. (F 161)

HER MAJESTY'S COLONIAL SERVICE

APPLICATIONS are invited for the following post:—

MAINS ENGINEER
Electricity Department, Aden

Appointment is pensionable on probation in the salary range £960-£1,788 per annum or on agreement in the salary range £1,500-£1,788 per annum, point of entry depending on approved experience. In addition, a temporary variable cost-of-living allowance of up to £240 per annum is also payable.

Free first-class passages are provided for officer, wife and up to four children under the age of 18 once each way each tour. Unfurnished quarters are available at rental of 10% of basic salary. Furniture can be obtained from Government sources at reasonable rates. Leave is granted at the rate of 7 days for each month of residential service in a tour of 18-24 months.

Candidates must be corporate members of the Institution of Electrical Engineers or hold equivalent qualifications, and have had extensive experience in the layout, operation and maintenance of distribution and transmission systems up to and including 11 kV. Organising and administrative experience required.

Apply in writing to the director of Recruitment, Colonial Office, Great Smith Street, London S.W.1, giving briefly age, qualifications and experience. Mention the reference number CDE. 145/2/02. (F 171)

BRITISH ELECTRICITY AUTHORITY

South Wales Division

Vacancy No. 73/53

APPLICATIONS invited for the following superannuable N.J.B. appointments:—

THIRD ASSISTANT ENGINEER (Statistics), Generation (Operation) Department, Divisional Headquarters, Cardiff. Salary, Grade 5, "AX/CX" (£640-£835 per annum).

Candidates should be university graduates, specialised in statistical subjects. Practical experience in the electricity supply industry an advantage.

Closing date, October 1, 1953.

Vacancy No. 74/53

STATION CHEMIST, Tir John Power Station, Swansea. Salary, Class "H," Grade 7 (£772-£802 per annum).

B.Sc. (Chem.) and/or A.R.I.C. Experience in water treatment, coal and oil testing, and corrosion problems desirable.

Closing date, October 10, 1953.

Application forms, obtainable from Secretary, South Wales Division, British Electricity Authority, Twyn-y-Fedwen Road, Gabalfa, Cardiff. (F 173)

BRITISH ELECTRICITY AUTHORITY

South Western Division

TECHNICAL STAFF VACANCIES

(a) DEPUTY POWER STATION SUPERINTENDENT Bath Generating Station. N.J.B. "D" 3, £813-£843.

(b) SHIFT CHARGE ENGINEER, Newton Abbot Generating Station. N.J.B. "F" 7, £697-£718.

Superannuation scheme.

Candidates for (a) should have had good technical education and considerable experience in the operation, maintenance and administration of a generating station, and preferably be corporate members of a recognised engineering institution.

The successful candidate will be responsible to the Station Superintendent of the jointly supervised Bath and Feeder Road Generating Stations.

For (b) candidates should have had considerable experience in a modern generating station. Graduate or corporate membership of a recognised engineering institution or equivalent desirable.

Applications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26 Oakfield Road, Bristol 8, should be completed and returned by September 30, 1953. (F 169)

YORKSHIRE ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:—

No. 3 (Sheffield) Sub-Area

GENERAL ASSISTANT ENGINEER
(Operational Control)

Applicants should have technical qualifications preferably to Higher National Certificate standard, and must have had operational experience on a large electricity supply system.

The successful candidate will be expected to take charge of the Sub-Area Control Room during his shift, working on a five-man shift rota. During this period of duty he will be expected to carry out emergency operational switching on the heavy industrial part of the system in the vicinity of the control room. His duties will include the control of all switching carried out by other engineers in the Sub-Area during his period of duty.

Salary, N.J.B., Class "N," Grade 13, £692 to £716 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial Street, Sheffield, not later than October 1, 1953.

No. 4 (Leeds) Sub-Area

Wetherby District
FIRST ASSISTANT DISTRICT ENGINEER

The appointment calls for experience in the planning, construction, operation and maintenance of h.v. and l.v. underground and overhead distribution systems.

Applicants should preferably have held a senior position in a mixed urban and rural district and corporate membership of the Institution of Electrical Engineers or equivalent qualification is necessary. The appointment will be subject to the applicant being prepared to reside in the District.

Salary, N.J.B., Class "E," Grade 5, £740 to £774 per annum.

INSTALLATION ENGINEER

The appointment calls for a good general and technical education and experience in all classes of installation and service work likely to be encountered in a mixed urban and rural district, and the ability to take charge of an installation department.

Applicants should preferably be corporate members of the Institution of Electrical Engineers.

The successful applicant will be required to reside in the district.

Salary, N.J.B., Class "E," Grade 8, £619 to £629 per annum.

CONSUMERS' ENGINEER
(Garforth)

The appointment calls for a good general and technical education and ability to undertake all commercial duties, including installation work, in a mixed urban and rural district.

Applicants should preferably be corporate members of the Institution of Electrical Engineers.

The successful applicant will be stationed at the Garforth Sub-Office and will be required to reside in the locality.

Salary, N.J.B., Class "E," Grade 8, £619 to £629 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Electricity Board, Bramhope, Leeds, not later than October 1, 1953.

No. 7 (Grimsby) Sub-Area

Grimsby District
THIRD ASSISTANT DISTRICT ENGINEER
(two posts)

Applicants should preferably be corporate members of the Institution of Electrical Engineers or hold other equivalent qualifications. They should have experience in the design construction, operation and maintenance of h.v. and l.v. overhead and underground distribution networks, sub-station plant and ancillary equipment.

Salary, N.J.B., Class "F," Grade 9, £607 to £629 per annum.

Scunthorpe District
GENERAL ASSISTANT DISTRICT ENGINEER

Applicants should preferably be Graduates of the Institution of Electrical Engineers or hold either the Higher National Certificate in Electrical Engineering or an equivalent qualification. They should have experience in the construction, operation and maintenance of h.v. and l.v. overhead and underground distribution systems.

Salary, N.J.B., Class "F," Grade 11, £548 to £565 per annum.

Gainsborough District
GENERAL ASSISTANT DISTRICT ENGINEER

Applicants should preferably be Graduates of the Institution of Electrical Engineers or hold either the Higher National Certificate in Electrical Engineering or an equivalent qualification. They should have experience in the construction, operation and maintenance of h.v. and l.v. overhead and underground distribution systems.

(*Continued in next column*)

(*Continued from previous column*)

Salary, N.J.B., Class "D," Grade 11, £500 to £516 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Road, Grimsby, not later than October 1, 1953. (F 156)

COUNTY BOROUGH OF CROYDON

Education Committee

CROYDON POLYTECHNIC

APPLICATIONS are invited for appointment as ASSISTANT LECTURER (Grade A) in the Electrical Engineering Department to take practical and theory classes in the City and Guilds Electrical Installation Courses.

Applicants should have had good experience in the electrical contracting industry, and should have technical qualifications of either Graduate or of Higher National Certificate (Electrical) standard. Teaching experience in either a full-time or part-time capacity or the ability to offer subjects up to Ordinary National Certificate (Electrical) standard would be added recommendations.

The salary will be in accordance with the Burnham Technical Scale (London Area). The successful applicant will be required to take up duties as soon as possible.

Further particulars and forms of application are obtainable (on receipt of a stamped addressed foolscap envelope) from the undersigned, to whom completed forms should be returned within 14 days of the appearance of this advertisement.

Note: The Committee are unable to provide housing accommodation.

HERBERT ROBERTS,
Chief Education Officer.

Education Office,
Katharine Street,
Croydon, Surrey. (F 146)

BRITISH ELECTRICITY AUTHORITY

South Eastern Division

LITTLEBROOK POWER STATION
(Class "M", 480 MW)
SHIFT CHARGE ENGINEER

APPLICANTS should preferably hold an engineering degree or be corporate members of the Institution of Electrical Engineers and/or Institution of Mechanical Engineers, and have had extensive experience in the operation of modern high-pressure turbine and boiler plant and e.h.t. switchgear. Considerable experience in administration and in the control of labour essential. Preference will be given to those with P.F. experience. Assistance with housing accommodation may be possible for those living at present in rented property. Grade 7, £1,035 6s. per annum.

ASSISTANT ENGINEER (OPERATION AND EFFICIENCY)

Candidates should preferably possess an engineering degree or be corporate members of either the Institution of Mechanical or Electrical Engineers. The successful applicant will be responsible to the Station Superintendent for the efficient operation, technical investigations and plant testing of the power station plant. Grade 5, £1,189 per annum.

National Joint Board Conditions of Service. Salaries quoted include London Allowance.

Applications giving details of education, present position, experience, etc., should be received by the Station Superintendent, Littlebrook Generating Station, near Dartford, Kent, not later than September 26. (F 160)

SOUTHERN ELECTRICITY BOARD

DRAUGHTSMAN (CIVIL ENGINEERING)

NO. 1 (SOUTHALL) Sub-Area, Waterloo Road, Uxbridge. Salary—N.J.B., Schedule D, Grade 6 (£458 to £595 7s., including London Weighting). N.J.B. Conditions of Service.

Applicants should have had training and experience in building construction and the design of steelwork and reinforced concrete structures, and be capable of preparing drawings and making calculations.

The successful candidate will be required to contribute to the B.E.A. and Area Boards' Superannuation Scheme, if eligible.

Applications, on forms obtainable from the Sub-Area Secretary, 2-6 Windmill Lane, Southall, and returned to him not later than September 28, 1953. (F 159)

BRITISH ELECTRICITY AUTHORITY

North Western Division

VACANCY No. 208/53. ASSISTANT SHIFT CHARGE ENGINEER, Willow Holme Power Station, Carlisle. Salary £607 to £629 (N.J.B. F.9).

Vacancy No. 209/53. ASSISTANT SHIFT CHARGE ENGINEER, Chadderton (H.P.) Power Station, near Oldham. Salary £641 to £667 (N.J.B. G.9).

Apply to Establishments Officer, British Electricity House, 825 Wilmslow Road, Manchester 20, before September 26. Quote vacancy No. (F 157)

LONDON ELECTRICITY BOARD

OPERATION AND MAINTENANCE BRANCH

APPLICATIONS are invited for the following positions in the North Eastern Sub-Area.

ENGINEER (O. and M.)
(2 vacancies)

Applicants should have had a sound technical education and possess a practical experience of all branches of engineering work associated with the organisation of a district distribution department, particularly in regard to substations and mains work.

These posts are graded under Schedule "A" of the National Joint Board Agreement as:

Class "F", Grade 10, £605 17s. to £627 18s. p.a. (1 post).
Class "E", Grade 10, £582 15s. to £597 9s. p.a. (according to experience).
Class "E", Grade 11, £550 4s. to £567 p.a. (according to experience).

These figures are inclusive of London Allowance.

JUNIOR ENGINEER
Ilford District

Applicants should have had a sound technical education, up to at least National Certificate standard, with practical experience on both d.c. and a.c. distribution systems and with the preparation and keeping of associated records.

The post is graded under the National Joint Board Agreement as Class "F", Grade 15, commencing salary £427 per annum inclusive, rising, in accordance with Clause 35, to Grade 14, £491 per annum inclusive of London Allowance.

Application forms obtainable from Establishments Officer, 46-47 New Broad Street, E.C.2, to be returned completed within 10 days from publication of this advertisement. Please enclose addressed envelope and quote Ref. V/1661/2/T. (F 159)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following post in the Transmission Department at Divisional Headquarters:—

THIRD ASSISTANT ENGINEER
(Civil Engineering)

Salary Class "AX/DX," Grade 5, £649-£858 per annum, plus London weighting.

Applicants should have had theoretical training and practical experience in civil and mechanical engineering, covering the setting out of site works, foundations for buildings and heavy plant, and, preferably, the construction of electrical transmission lines on steel lattice towers.

Applications, stating age, qualifications and experience, should be sent to the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, not later than October 3, 1953.

W. N. C. CLINCH,
Controller.
(F 170)

KARACHI ELECTRIC SUPPLY CORPORATION LTD.
Karachi, Pakistan

APPLICATIONS are invited for the post of MANAGER of the Corporation. Scale: Rs. 2,000-100-2,500-100-3,000 per mensem with no allowances other than car allowance of Rs.200 per mensem. (£1 equals about Rs.9.) Salary in the above scale according to qualifications and experience. Higher salary than the maximum of the the scale will be considered for deserving applicants. Residential accommodation will not be provided. The Corporation operates a steam power station at West Wharf equipped with five turbo sets each 5,000 kW at 11 kV, with 400 lb. oil-fired boilers, also a diesel station of total output of about 6,000 kW. The steam station runs in parallel with the diesel station. Transmission and distribution are at 11 kV, 6·6 kV and 0·4 kV with annual energy sales of 70 million kWh. Second steam station equipped with two 15,000 kW turbo sets, oil-fired boilers and 33 kV switchgear will come into commission in 1955. Applications marked "Application" on the envelope should be addressed to Mr. A. G. Khan, M.Sc. (Tech). (Manchester), M.I.Mech.E., M.I.E.E., Managing Director (Agents), Karachi Electric Supply Corporation, Ltd., Electric House, Elphinstone Street, Karachi, Pakistan, giving full particulars of age, qualifications and experience, also posts held and salaries drawn during the last 10 years. (F 191)

BRITISH ELECTRICITY AUTHORITY

GENERATION PLANT DESIGN, Sub-Branch, Headquarters, require a THIRD ASSISTANT ENGINEER (BOILER PLANT) to assist in technical and economic investigations in relation to boiler plant and ancillary equipment. Candidates should have an engineering degree or equivalent and experience in the manufacture of major items of power station mechanical plant, preferably those associated with boilers. Salary N.J.B. Grade 4, £753 to £981 inclusive. Forms from D. Moffat, Director of Establishments, Winsley Street, London, W.1, to be returned by October 3, 1953. Quote Ref. ET/420. (F 158)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

APPLICATIONS are invited for the following positions within the Division.

CIVIL ENGINEERING DRAUGHTSMEN
Construction Department
Vacancy No. 22/53

Candidates should have experience in design and detail of reinforced concrete structures, piled and slab foundations for heavy plant, culverts, cable subways, etc., for general building construction drainage and sanitation schemes, associated with office and administrative buildings.

The salary will be in accordance with Grade 5 (£567-£671 per annum) or Grade 6 (£433-£567 per annum) of Schedule "D" of the National Joint Board Agreement.

ENGINEERING DRAUGHTSMEN (MECHANICAL)
Construction Department
Vacancy No. 44/53

Senior Draughtsmen are required in the Mechanical Section of the Construction Department at North Wilford Power Station. Candidates should have experience in one or more of the following:—

(i) Design and layout of power station equipment, including turbo-alternators, boiler plant, coal and ash plant, and general station auxiliaries.
(ii) H.P. and L.P. steam and feed pipework. Condensing plant and feed heating systems.
(iii) Conveyor plant, coal-handling systems and material handling of station auxiliary equipment.

Salary and conditions of service will be in accordance with the National Joint Board Agreement, Grade 5 (£567-£671 per annum), and Grade 6 (£433-£567 per annum) of Schedule "D," according to experience.

ENGINEERING DRAUGHTSMEN (ELECTRICAL)
Construction Department
Vacancy No. 61/53

Candidates should have experience in the preparation of layouts and diagrams for the installation of E.H.T. and L.T. switchgear, transformers, E.H.T. and L.T. cables; knowledge of protective gear systems would be an advantage.

The salary will be in accordance with Grade 5 (£567-£671 per annum) or Grade 6 (£433-£567 per annum) of Schedule "D" of the National Joint Board Agreement.

STATION SHIFT CONTROL ENGINEER
Avon Power Station
Vacancy No. 90/53

Applicants should have had sound technical training and experience in the control of modern switchgear.

The salary will be in accordance with Class "E" Grade 10 (£555-£569 per annum) of the National Joint Board Agreement.

The closing date for this appointment will be September 21, 1953.

SHIFT CHARGE ENGINEER
Hinckley Power Station
Vacancy No. 96/53

Applicants should have had sound technical training and be fully experienced in the operation of steam power stations. The possession of an Ordinary National Certificate in Mechanical or Electrical Engineering or its equivalent will be an advantage.

The salary will be in accordance with Class "B," Grade 7 (£559-£586 per annum) of the National Joint Board Agreement.

The closing date for this appointment will be September 24, 1953.

THIRD ASSISTANT ENGINEER
Technical Department, Divisional Headquarters
Vacancy No. 97/53

Preference will be given to applicants who hold a degree in Electrical Engineering. Candidates should have had experience in the commissioning and maintenance of switchgear and protective gear.

Experience of the analysis of tenders and of technical correspondence is desirable.

The salary will be within Schedule "C," Class "AX DX," Grade 5 (£649-£858 per annum) of the National Joint Board Agreement.

The closing date for this appointment will be September 24, 1953.

The above positions will be pensionable within the provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form, which may be obtained from the Divisional Establishments Officer, British Electricity Authority, Barker Gate, Nottingham, and should be returned to the undersigned by the dates stated. Please quote vacancy number

L. F. JEFFREY,
Divisional Controller.
(F 160)

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18–64, or a woman aged 18–50; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments in the Northmet Sub-Area:—

(a) THIRD ASSISTANT ENGINEER
Harrow District

(b) THIRD ASSISTANT ENGINEER
Tottenham District

Candidates should have had a sound technical training and experience in the construction, operation and maintenance of H.V. and L.V. underground systems.

The salary for both appointments will be in accordance with the National Joint Board Salary Agreement, as follows:—

(a) Class "F," Grade 9, commencing at £607 plus London Allowance.
(b) Class "E," Grade 9, commencing at £587 plus London Allowance.

Future salary and conditions of service will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidates will be required to contribute to a superannuation scheme, and may be required to undergo a medical examination.

Applications, by letter, stating age, education, qualifications and experience, with details of present appointment and salary, should be submitted to the District Manager concerned within 14 days of the appearance of this advertisement.

Addresses of District Managers are as follows:—

District Manager, Harrow, Eastern Electricity Board, 4 College Road, Harrow, Middlesex.

District Manager, Tottenham, Eastern Electricity Board, 312 High Road, Tottenham, London N.15.

(F 172)

BRITISH ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for the following positions in the Construction Department at Divisional Headquarters:—

ENGINEERING DRAUGHTSMEN (ELECTRICAL)

Applicants should have had experience of the layout of switchgear, cables and lighting in connection with power station construction. Experience in schematic diagrams an advantage. Preference will be given to those possessing a Higher National Certificate or equivalent qualifications.

Salary, N.J.B. Schedule "D," Grade 5 (£567-£671) or Grade 6 (£432-£567), according to qualifications and experience.

Special application forms, obtainable from P. D. A. Oliver, Divisional Secretary, 111 High Street, Portsmouth, must be returned by September 30, 1953. (F 174)

BRITISH ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable post. Salary, including London allowance, and conditions of service in accordance with N.J.B. Agreement, Schedule A. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

JUNIOR ENGINEER (CONTROL ROOM)
Fulham Generating Station

Candidates should have had engineering training with technical qualifications. Salary—Class "L," Grade 16, £574 7s. per annum.

Application may be made on form obtainable from Divisional Secretary, B.E.A., London Division, Generation House, Great Portland Street, W.1, and be received within 14 days of this advertisement. (F 188)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

ASSISTANT SHIFT CHARGE ENGINEER is required at Ocker Hill Power Station. N.J.B. service conditions. Superannuable appointment. Salary within Schedule "A," Grade F9, commencing at £607 per annum.

A sound technical training and practical experience in the operation and maintenance of steam generating plant and main switchgear required. Appropriate technical qualifications an advantage.

Apply on Forms AE6, available from the Establishments Officer, 53 Wake Green Road, Moseley, Birmingham 13, by October 3, 1953. (F 175)

A QUALIFIED industrial CHEMIST is required and should be capable of progressing to the position of chief chemist. He should preferably have experience of extrusion plastics and/or cable making. Salary according to qualifications and experience; the appointment is permanent and pensionable.—Box No. 2905, Electrical Times. (F 148)

BOX No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London W.C.2

JOHNSON & PHILLIPS, LIMITED

APPLICATIONS are invited from Electrical Engineers for senior positions in the Company's India and Pakistan organisations.

The Company has long established organisations in the territories for the sale of the Company's products which include cables, transformers, switchgear, capacitors and domestic electrical equipment. The Company also maintains Contract Departments for complete industrial and other electrification schemes and the installation of the Company's products. In addition, the Company has a factory in Pakistan for the manufacture of switchgear and, in collaboration with an associated company, a similar factory in India.

Candidates must have had considerable technical and commercial experience in some or all of the foregoing activities such as to enable them to take executive positions leading possibly to management.

Candidates should preferably be not more than forty years old.

Applications (which will be treated in strict confidence) should be as complete as possible and should be addressed to:—

The Managing Director,
Johnson & Phillips, Ltd., Charlton, London S.E.7

(F 110p)

A METER DEVELOPMENT ENGINEER required by the English Electric Co. Applicants should have attained H.N.C. or degree standard and have some experience of design or manufacture of electricity meters and/or ancillary devices. Preference will be given to men with original ideas who can translate them into effective practical devices. The successful applicant will be located at the company's modern meter factory in Stafford. Salary up to £800 dependent on experience. —Write giving details to Dept. C.P.S., 336-7 Strand, London W.C.2, and quoting reference 1173. (F 145)

AN OPPORTUNITY occurs for University Graduates in a well-established progressive cable manufacturing company in the Greater London area. The successful candidates holding arts, science or engineering degrees would be trained for MANAGERIAL appointments. Salary according to qualifications and experience (if any).—Box No. 2907, Electrical Times. (F 149)

ASSISTANT MECHANICAL MAINTENANCE ENGINEER required for organisation in East London district operating large electrical stations. Applicants should have wide and up-to-date experience in the maintenance of modern generating station power plant and be capable of supervising turbine and boiler overhauls. Technical qualifications should be sound. Age not less than 32 or over 45. Commencing salary approximately £950 per annum with non-contributory pension. Position has excellent prospects.—Reply to Box No. 2889, Electrical Times, quoting reference TME/7. (F 52)

A VACANCY has occurred for the position of SENIOR ELECTRICAL AND MECHANICAL ENGINEER, with first-class qualifications, on the staff of a well-known electrical contracting firm in London. Experience of contracting as opposed to manufacturing essential.—Write, stating education, qualifications, age, experience and salary required, to Box No. 2919, Electrical Times. (F 176)

CENTRAL London drawing office of The English Electric Co., Ltd., has vacancies for MECHANICAL DRAUGHTSMEN to be engaged on high-voltage switchgear. Good workshop and D.O. experience essential, as the positions carry responsibility for detail design for most efficient production. Excellent canteen facilities available.—Write, quoting Ref. 112M, to Dept. C.P.S., 336-7, Strand, London W.C.2. (F 162)

CONTRACT ENGINEERING APPOINTMENTS are available with The English Electric Company, Ltd., on important work covering all classes of electrical equipment. These appointments are pensionable after a qualifying period and apprentice trained men with Higher National Certificate in Electrical or Mechanical Engineering or equivalent, and with previous experience on contract work are required. Experience in the manufacturing or power supply industries or in the application or installation of electrical equipment in any branch of industry or engineering is an alternative qualification, and professional engineers in these fields are also invited to apply. A number of vacancies also exist for APPRENTICE TRAINED ENGINEERS who have not yet had any opportunity of acquiring contract experience.—Apply, quoting Ref. S.A.33B, to Dept. C.P.S., 336-7 Strand, W.C.2. (F 190)

DESIGNER required by old-established manufacturers of electrical accessories, 30 miles south-west of London. Sound electrical knowledge essential, coupled with initiative, drive and flair for new ideas.—Write, stating experience, qualifications and salary required, to Box No. 2921, Electrical Times. (F 177)

ELECTRICAL OR MECHANICAL ENGINEER to undertake the development of wiring systems, cables and fittings. A knowledge of practice and regulations in this field is desirable. Applicants should be capable of initiating new designs and should preferably have knowledge of production techniques for small electrical fittings. Appointment will be to the permanent staff after the usual probationary period, and remuneration will be in accordance with age, experience and qualifications.—Box No. 2923, Electrical Times. (F 178)

ELECTRICIAN required for Middle East. Experienced in use of conduit, Pyrotenax, earthing, etc.—State age, experience, with copies of testimonials or names to whom we may apply to Box No. 2909, Electrical Times. (F 152)

GRADUATE MECHANICAL OR ELECTRICAL ENGINEER for an interesting and progressive post connected with development work on special cables; location, Prescot Works. Candidates should preferably be below the age of 30, with some previous industrial experience, not necessarily with the cable industry. Appointment will be to the permanent staff after the usual probationary period, and remuneration will be in accordance with age, experience and qualifications.—Applications in the first instance should be submitted by letter to the Staff Officer, B.I.C.C. Ltd., Prescot, Lancs. (F 179)

JOHNSON AND PHILLIPS invite applications for the appointment of CHIEF RUBBER TECHNOLOGIST, to fill a vacancy which will shortly be created by retirement.

Applicants should hold scientific qualifications of University Degree or comparable standard and must possess extensive experience in senior capacity of the design and manufacture of rubber and thermoplastic cables with intimate knowledge of materials and compounds. They will be expected to be thoroughly familiar with the principal British and foreign cable specifications.

The duties involve overall responsibility to the Cable Test and Research Manager for all routine technical work relating to rubber cables and materials and for research and development. They cover laboratory activities, supervision of factory processes and assessment of cable design and performance. Particular importance is attached to competence in dealing with customers' inquiries and other technical problems relating to installation and operating conditions for rubber cables of all types.

Applications, giving full particulars of age, education, training experience and salary required, should be sent to Employment and Welfare Manager, Victoria Way, Charlton, S.E.7, marked Rubber Technologist and will be treated with the utmost confidence. (F 85)

LANCASHIRE DYNAMO AND CRYPTO, LTD., Trafford Park, Manchester 17, have a vacancy for a SENIOR INSIDE SALES ELECTRICAL ENGINEER tendering for rotating plant and associated switchgear.—Applications are invited stating age, experience and salary required to the Personnel Manager. (F 151)

OVERHEAD LINESMAN required for Middle East, experienced in erection of steel and wood poles and lines up to 33 kV.—Apply stating age, experience and forward copies of testimonials or state names to whom we may apply, to Box No. 2911, Electrical Times. (F 153)

OVERHEAD LINESMAN required immediately for work overseas. Must be fully experienced in all branches of overhead line work up to 11 kV.—Write, giving full details of previous experience, to Box No. 2913, Electrical Times. (F 163)

PROFESSIONAL ENGINEERS IN VARIOUS GOVERNMENT DEPARTMENTS. The Civil Service Commissioners invite applications for about 75 pensionable posts in a wide variety of mechanical and electrical engineering duties. Applications will be accepted up to December 31, 1953.

Candidates must be under 35 on January 1, 1953, with extension for regular service in H.M. Forces and up to two years for permanent civil service. For the Post Office they must be at least 21, for the Ministry of Supply and Ministry of Civil Aviation at least 23, and for all other departments at least 25 on that date.

Generally a candidate must possess a University degree in Engineering or be a Corporate Member of one of the professional institutions—Mechanical Engineers, Electrical Engineers, or Civil Engineers or have passes in, or exemption from, Sections A and B of the corresponding Associate Membership examinations. Exceptionally candidates of high professional attainment, but without the specified qualifications, may be admitted. For some posts Associate Fellowship of the Royal Aeronautical Society or an Honours degree in Physics will be accepted.

Salary scale (men in London) £650 (at age 25) to £1,000. Starting salary according to age up to £900 at 34. Candidates entering below age 25 will start at salaries varying from £450 at age 21 to £570 at age 24. Prospects of promotion. Salaries of next higher grades are £1,000 to £1,320 and £1,375 to £1,575. Somewhat lower for women and in the provinces.

Further particulars and application forms from Civil Service Commission, Scientific Branch, Trinidad House, Old Burlington Street, London W.1, quoting No. 585/53. (F 166)

PERMANENT POSITIONS

with excellent opportunities, will be offered to applicants suitably qualified for the following:—

(a) DESIGNERS experienced in electronic control gear. Good electrical and mechanical design and layout ability essential.

(b) SENIOR DRAUGHTSMEN with electrical/mechanical experience required for motor control gear, knowledge of electronics advantageous. Thorough shop training and extensive drawing office experience essential.

(c) DRAUGHTSMEN required for mechanical and electrical work on industrial electronic equipment. Experience on this type of product whilst an advantage is not essential and men with good electrical or mechanical drawing office experience will be considered.

Vacancies exist in a new factory in the Stoke-on-Trent area. Replies giving full details of training experience, also age and salary required, and quoting Ref. AG1 to be sent to Box No. 2915, Electrical Times. (F 164p)

POWER STATION INSTRUMENT ENGINEER required by the Kuwait Oil Company for service in Kuwait. In addition to A.M.I.E.E. or similar qualification, must have received full training with firm of electrical instrument manufacturers or in a power station and have some subsequent experience in the calibration and repair of all types of instruments used in a modern power station. Age under 35. Salary starting £910 p.a. clear, plus generous allowances, pension scheme and kit allowance.—Write for application form, giving brief details and quoting K.1744, to Box B/36, c/o 191 Gresham House, E.C.2. (F 165)

SALES ENGINEER wanted for manufacturers of automatic temperature controls. Good sales record and sound technological training essential. Age 25/35.—Send details to Box No. 2925, Electrical Times. (F 160)

SALES ENGINEER, young, required by progressive thermostat and control equipment manufacturers to call on users in London and Southern England.—Full details to Box No. 2917, Electrical Times. (F 167)

SOUTH AFRICA. Factory near Cape Town requires two ELECTRICIANS. Must be experienced in high- and low-tension associated with switchgear and motors. Excellent terms and prospects, with passage assistance.—Apply, 1820 Settlers' Association, Grand Buildings, Trafalgar Square, London W.C.2. (F 161)

TELEPHONE CABLE MAKERS have a vancancy in their outside installation department for an ENGINEER or ASSISTANT MANAGER with an engineering degree. Location in London, but considerable travelling may be necessary. Salary according to qualifications and experience; the appointment is permanent and pensionable.—Box No. 2903, Electrical Times. (F 147)

TEST BED experience on L.T. hand and automatic contactor equipment offered to young WIREMAN or men, with some practical electrical experience, by expanding Merseyside firm.—Box No. 2927, Electrical Times. (F 182)

THE ENGLISH ELECTRIC COMPANY requires a DEMONSTRATOR for the Yorkshire Area, to be centred on Leeds; and a demonstrator for the Midlands Area, to be centred on Birmingham. A good domestic science background is required, together with sales experience and a knowledge of domestic electrical appliances.—Reply quoting ref. 1027A, to Dept., C.P.S. 336/7 Strand, London W.C.2. (F 150)

THE METALS DIVISION of Imperial Chemical Industries Ltd. invites applications from ENGINEERS to fill vacancies in the Mechanical Engineering and Electrical Engineering Sections of its Engineering Department at Birmingham. The work involves the design, installation and maintenance of heavy machinery used in the rolling and extruding of non-ferrous metals, as well as work on small, intricate machinery. Candidates should preferably possess an honours degree or an equivalent qualification, and will be paid a commencing salary of up to £1,100 per annum, depending on age, qualification and experience. Opportunities also exist for advancement beyond this salary level.—Applications in writing should be addressed to the Assistant Staff Manager, I.C.I. Metals Division, Witton, Birmingham 6. (F 183)

TRANSFORMER DRAUGHTSMEN required with some experience on units in the range 500 to 10,000 kVA. Salary according to qualifications.—Apply Technical Director, Bryce Electric Construction Co. Ltd., Kelvin Works, Hackbridge, Surrey. (F 138)

YOUNG ENGINEERS who have a knowledge of Power Transformers and H.N.C. electrical are invited to apply for sales and contracts positions with English Electric at Stafford Training may be given to suitable candidates.—Write quoting ref. 396H to Dept. C.P.S. 336/7 Strand, London W.C.2. (F 101)

11 kV PLUMBER CABLE JOINTER required for contract work in this country. Headquarters will be South Wales. Permanent employment for first-class man.—Box No. 2899, Electrical Times. (F 139)

APPOINTMENTS WANTED

ELECTRICAL ENGINEER requires position with progressive contractor as Manager/Engineer, estimating, supervision, inquiries followed through to invoicing, control of staff.—Box No. 2859, Electrical Times. (F 32)

M. P.O.A., M.P.I.M. EXECUTIVE, age 39 years, with wide buying production, personnel and administrative experience, seeks change of appointment, preferably as manager. Power transformer and electrical engineering background. Present salary £750 per annum; present company 15 years.—Box No. 2891, Electrical Times. (F 98)

WORK WANTED

A. C. and d.c. MOTOR REWINDS and REPAIRS. Prompt service fully guaranteed. Edgware 5566 (4 lines) —Service Electric Co., Ltd., Stanmore, Middx. (F 13)

ARMATURE REWINDING service to the trade. Vacuums, Drills, Grinders, Hood Dryers, Dental Motors. Vacuum cleaner and drill armatures replaced from stock. 24-hour service. Every job guaranteed. All vacuum cleaner parts, hoses, etc., in stock for any make. Apex washer agitator shafts stocked.—Regam Electric Cleaner Service, 95 Park Lane, Leeds 1. (F 22)

FISHER FOUNDRIES LTD., Greet, Birmingham, have immediate capacity for machine moulded PRECISION CASTINGS in gunmetal and grey iron, ¼ to 30 lb. All castings shot blasted.—Telephone: Birmingham, Victoria 0197. (F 16)

METALWORK. All types cabinets, chassis, racks, etc. to your own specification.—Philpott's Metalworks Ltd., Chapman Street, Loughborough. (F 20)

MOTOR REPAIRS and REWINDS to the trade, prompt guaranteed service. F.H.P. to 10 h.p. Collect and deliver in London area. —H. J. Mugdan Ltd., Paddington, W.2. Ring Pad. 5210 or 2967. (F 184)

WORK WANTED. Capacity available for all types of COIL WINDING.—Box No. 2425, Electrical Times. (F 17)

WANTED

A. C.-D.C. MOTORS, STARTERS, complete change-over installations, etc.—A.A. Electrical Co., Ltd., 67 Rothschild Road, Chiswick Park, W.4. Tel.: Chiswick 5105. (F 8)

ELECTRIC MOTOR. 230/1/50, 2,400-3,000 r.p.m., ¾ h.p. Totally enclosed preferred. State weight.—Weston Bros., 76 Oval, Bath. (F 192)

TOWER WAGON. Tower Wagon required for the installation of lighting equipment inside factory.—Price and details to Derby Aviation, Ltd., Derby Airport, Burnaston, Derby. (F 88)

WANTED. D.C. and A.C. ball-bearing MOTORS, MOTOR GENERATOR SETS, DYNAMOS and ALTERNATORS.—Full details to Britannia Manufacturing Co., Ltd., 22-26 Britannia Walk, London N.1. (F 4)

WANTED, for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of secondhand machinery and plant for re-use.—W. and H. Cooper, Ltd., 176 Brady Street, Bethnal Green, E.1. (F 1)

WANTED. Large quantity of 4-in. outside diameter TUBES from the dismantling of old Babcock water-tube boilers. Best prices paid. Prepared to purchase Babcock and Wilcox water-tube boilers for dismantling —Apply, giving full details, to Midland Iron and Hardware Co., Cradley Heath, Staffs. (F 2)

WANTED, ROTARY CONVERTERS, any size.—Universal, 221 City Road, London E.C.1. (F 6)

FOR SALE

CABLES & WIRE

RANDOM LENGTH CABLE—CHEAPER
Nothing under 20 yds. Everything Guaranteed.
Twin per 100 yd. lot.

	3/029	3/029 W/E	7/029	1/044
CAPOTHENE	53/-	64/-	84/-	36/-
T.R.S.	58/-	74/-	92/-	44/-

FLEX. Plastic T.T. or flat. 13/9. Maroon T.T., 24/- per 100. Maroon in 10-20 yd. lengths, 20/- per 100. Send for full lists including bankrupt price standard coils.

BRITISH DISTRIBUTING CO.
591 Green Lanes, London N.8. (F 141p)

ENGINEERING PLANT & MATERIALS

B.M.S. BARS, CHEAP. 5/32 in., 1¼ tons; 0·120 in., 5 cwt.; ¼ in., 1 ton; 9/32 in., 2 tons; 21/64 in., 2 tons; 11/32 in., 6 tons. 5/32 in. LEDLOY, 2 tons. ⅜ in. EN 32 M, ¼ ton. 7/16 in. B.M.S., 2 tons. 16 and 18 g FLAT GAL. SHEETS.—Dyas and Fowle, 41 Loudoun Road, N.W.8. MAI 5489. (F 193)

GENERATING PLANT

FLINT BOROUGH COUNCIL
FOR SALE
GENERATING PLANT

THE COUNCIL invites offers for the two generating plants scheduled below. The plants may be inspected by arrangement with the Borough Engineer and Surveyor, Municipal Offices, Earl Street, Flint. Offers for one or both plants should be submitted in a plain envelope endorsed "Offer for Generating Plant" to reach the undersigned not later than 2.30 p.m. Monday, October 19, 1953.

The Council do not bind themselves to accept the highest or any offer.

SCHEDULE

One 9 kVA B.T.H. alternator, 230 V single phase, 4 cylinder Meadows petrol motor 12 h.p. 1,500 r.p.m., with switchboard, etc.

One 2.75 kVA. Douglas horizontally-opposed engine with type 2ZIA alternator 3,000 r.p.m., 130 V 50 cycles, 3 phase.

D. H. DAVIES.
Town Clerk.
Town Hall, Flint.
September 11, 1953. (F 154)

FOR SALE, "Atlas" vertical five-cylinder DIESEL ENGINE, 725 h.p., 250 r.p.m., by British Polar Engines, Ltd. No. E.162, coupled to a 600 kVA 250 r.p.m. alternator (ASEA) type G166, 440 V 3-phase 50-cycles, 787 amps, continuous rated.—London Brick Co., Ltd., Africa House, Kingsway, London W.C.2. (F 62)

FOR SALE, GENERATING SET, comprising Petter TX3 diesel engine, 106 h.p., 500 r.p.m. with all auxiliaries: Petter SS3 diesel engine, 185 h.p., 500 r.p.m., with all auxiliaries; Lawrence Scott 10 kW 110 V, 1,500 r.p.m. d.c. generator, complete with switchboard.—C. W. Pittard and Co., Ltd., Sherborne Road, Yeovil. (F 63)

LIGHTING EQUIPMENT

PURLEY CHOKES AND BALLASTS. Our 80-W tapped h.p.f. ballast with starter switchgear-holder, incorporated, is proving itself the most popular unit. Suitable for most fittings 57s. 6d. each subject.—F. W. Blanshard Ltd. (Dept. E.T.), Purley, Surrey. Uplands 4818-9. (F 14)

METERS

A. C.-D.C. QUARTERLY and SLOT METERS.—Brent Electrical Co., 6 Holmdale Gardens, London N.W.4. (F 5)

HOUSE-SERVICE METERS, a.c. or d.c., quarterly or prepayment.—Universal Electrical, 221 City Road, London E.C.1. (F 10)

MOTORS & STARTERS

A. A. ELECTRICAL CO. for A.C.-D.C. MOTORS, SWITCHGEAR, EXHAUST FANS, HOISTS, REDUCTION GEARS, new or reconditioned units.—Chiswick 5105, Chiswick 5606, 67 Rothschild Road, W.4. (F 7)

FLAMEPROOF MOTORS, M.G. SETS, D.C. MOTORS, GEARED MOTORS, A.C. MOTORS, TRANSFORMERS, CONTROL GEAR. SPECIALS. FLANGE MOTORS.

ELECTROPOWER COMPANY LIMITED

Kingsbury Works, Kingsbury Road, London, N.W.9.
Tel.: COLindale 4621/3
Grams: Lektropowa, Hyde, London. (F 12)

A. C. and D.C. MOTORS, all sizes, large stocks. Fully guaranteed.—Milo Engineering Works, Ltd., Milo Road, East Dulwich, S.E.22. (Forest Hill 2278-9.) (F 3)

A. C. and D.C. MOTORS, GENERATORS from stock.—Service Electric Co., Ltd., Honeypot Lane, Stanmore, Middx. Edgware 5568-9. (F 9)

FOR IMMEDIATE SALE. 2 Brooks electric MOTORS, 2 h.p., 710 r.p.m. 1 Tilling-Stevens, 1·5 h.p., 1,430 r.p.m. 2 Metro-Vickers, 1 h.p., 1,425 r.p.m. 1 Electro Gear, ¾ h.p., 1,425-16 r.p.m. 1 Metro-Vickers, 1 h.p., 1,425 r.p.m. 1 Brooks, 20 h.p., 2,280 r.p.m.—Box Y 40, Smiths Bookshop, Camborne, Cornwall. (F 194)

FLAMEPROOF Group II s/cage MOTORS. 400 V, 3-phase, 50-cycles supply.
2—Mather and Platt, 35 h.p., 750 r.p.m.
3—B. Peebles, 25 h.p., 3,000 r.p.m.
1—E. Electric, 9 h.p., 1,000 r.p.m.
1—E.P.E., 5 h.p., 1,500 r.p.m.
2—Brook, 5 h.p., 3,000 r.p.m.
17—E. Electric, 3.75 h.p., 1,500 r.p.m.
2—L. D. and C., 1.5 h.p., 3,000 r.p.m.
Apply: Whitefield Machinery and Plant Ltd., Cobden Street, Pendleton, Salford, 6. (F 185)

UNUSED SQUIRREL CAGE MOTORS 400/440/3/50. For immediate delivery at attractive prices.

Qty.	H.P.	Speed	Frame
BROOK. TOTALLY ENCLOSED			
6	3	2,880	SC8
3	4	1,430	SC10
12	5	1,430	SC10
13	7½	1,430	SC11
11	10	1,430	SC12
11	12½	1,450	SC13
3	17½	1,440	SC14
BROOK. SCREEN PROTECTED			
7	12½	1,440	R.S.14
15	15	1,440	R.14
7	17½	1,400	R.15
BULL. TOTALLY ENCLOSED			
15	1½	1,430	SAOC
19	3	2,840	SO.220
3	10	1,465	SD1C
3	12½	1,465	SD2C

George Cohen Sons and Co., Ltd., Wood Lane, London W.12 (Tel.: Shepherds Bush 2070), and Stanningley, near Leeds (Tel.: Pudsey 2241). (F 113)

12 NEW Brook R.13 SLIP-RING MOTORS for sale. 7½ h.p., 1,420 r.p.m., 380/420 V 3 ph. 50 c/s.—F. J. Edwards, Ltd., 359 Euston Road, London N.W.1. EUSton 4681. (F 195)

SWITCHGEAR

MERCURY SWITCHES are made by Hall, Drysdale and Co., Ltd., of 58 Commerce Road, Wood Green, London N.22. Tel.: BOW 7221. (F 11)

TIME SWITCHES for sale. Reconditioned or new, 12 months' guarantee. Immediate delivery. Lists from J. W. Hughes, 3 St. Thomas' Street, London Bridge, S.E.1. (Tel.: HOP 2759). (F 23)

TRANSFORMERS & CONVERTERS

HACKBRIDGE AND HEWITTIC MERCURY-ARC RECTIFIERS for operation on standard voltage 3-phase, 50-cycles supply line.
1—460 kW 230 V d.c. output.
1—150 kW 230 V d.c. output.
1—126 kW 420 V d.c. output.
1—80 kW 400 V d.c. output.
1—75 kW 220 V d.c. output.
1—75 kW 220-0-220 V d.c. output.
1—65 kW 110 V d.c. output.
1—15 kW 220 V d.c. output.
Apply: Whitefield Machinery and Plant Ltd., Cobden Street, Pendleton, Salford 6. (F 186)

UNCLASSIFIED

A HIGH VACUUM IMPREGNATION UNIT or single or batch coil impregnation service to B.I.C. Specification 214 or individual requirements.—Blickvac, 505 Lordship Lane, S.E.22. Tel.: Forest Hill 7089. (F 18)

VITREOUS STEEL NOTICE PLATES complying with I.E.E. regulations. "Danger—High Voltage," 6 in. by 2 in., 1/3 each. "Lock Switch," etc., 6 in. by 4 in., 1/8 each. "Fire Switch," 6 in. by 4 in., 1/5 each. "Fire Switch" (with name and address), subject to quantity. "I.E.E. Inspection Notice," 1/4 each. Foicik Ltd., 36-38 Western Road, Plaistow, London E.13. (Tel.: GRA. 4524.) (F 187)

MISCELLANEOUS

CITY AND GUILDS (Electrical, etc.) on "No Pass—No Fee" terms. Over 95 per cent. successes.—For full details of modern courses in all branches of Electrical Technology send for our 144-page handbook FREE and post free.—B.I.E.T. (Dept. 39), 17 Stratford Place, London W.1. (F 15)

LONDON COUNTY COUNCIL

Courses of Instruction for members of the staff of the electricity supply undertakings are provided at:—

EAST LONDON COLLEGE OF COMMERCE, Vallance Road, Whitechapel Road, E.1.

PECKHAM COLLEGE OF COMMERCE, Peckham School, Sumner Road, Peckham Road, S.E.15.

WEST LONDON COLLEGE OF COMMERCE, Childerley Street, Fulham Palace Road, S.W.8.

NORTH-WESTERN POLYTECHNIC, Prince of Wales Road, Kentish Town, N.W.5.

WOOLWICH POLYTECHNIC, Thomas Street, S.E.18.

The Courses include ELECTRICITY ACCOUNTS AND LAW, ECONOMICS, MERCANTILE LAW, STATISTICS.

Classes commence Monday, September 28. Enrolment as from September 21.

Copy of Prospectuses may be obtained from the Principals at the Colleges. (748.) (F 104p)

FREE! Brochure giving details of courses in ELECTRICAL ENGINEERING and ELECTRONICS, covering A.M.Brit.I.R.E., City and Guilds, etc. Train with the Postal Training College, operated by an Industrial Organisation. Moderate fees.—E.M.I. Institutes, Postal Division, Dept. ET. 29, 43 Grove Park Road, London W.4 (Associate of H.M.V.) (F 21)

LONDON COUNTY COUNCIL

EVENING COURSES
in
ELECTRICAL AND MECHANICAL ENGINEERING

Commence, at the following Technical Colleges on September 28, 1953.

Colleges open for enrolment from September 21, 1953.

Hackney Technical College, Dalston Lane, E.8 (Tel.: AMHerst 0029).

Paddington Technical College, Saltram Crescent, W.9 (Tel.: LADbroke 1343).

Poplar Technical College, Poplar High Street, E.14 (Tel.: EASt 3161).

South East London Technical College, Lewisham Way, S.E.4 (Tel.: TIDeway 1421).

Wandsworth Technical College, Wandsworth High Street, S.W.18 (Tel.: VANdyke 2356).

Students prepared for National Certificates and City and Guilds of London Examinations. (749) (F 103p)

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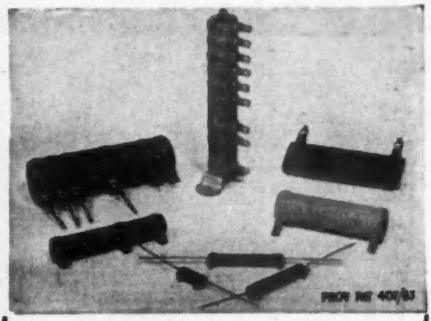

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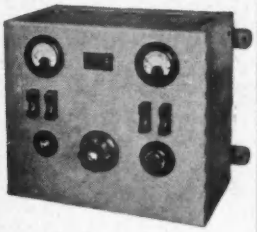

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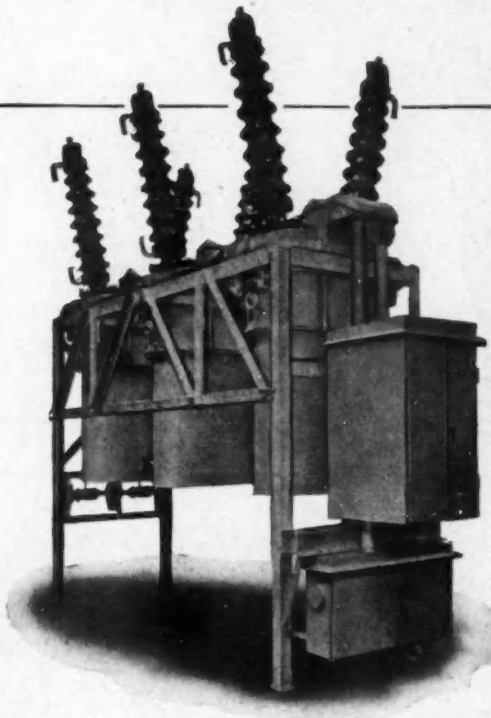

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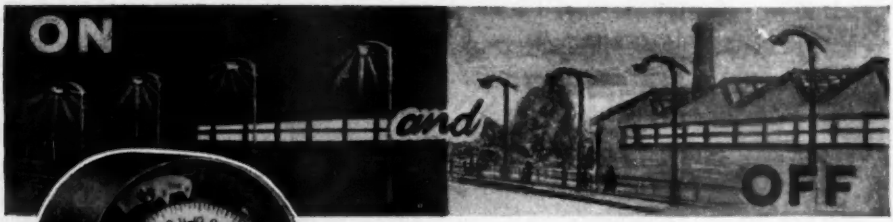

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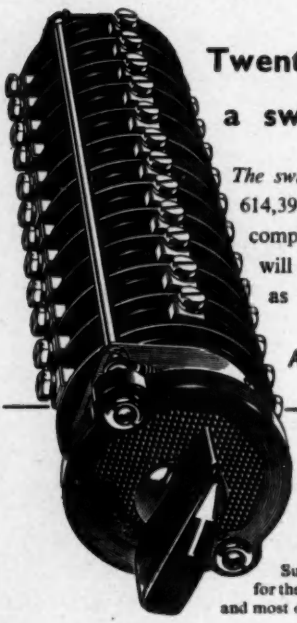

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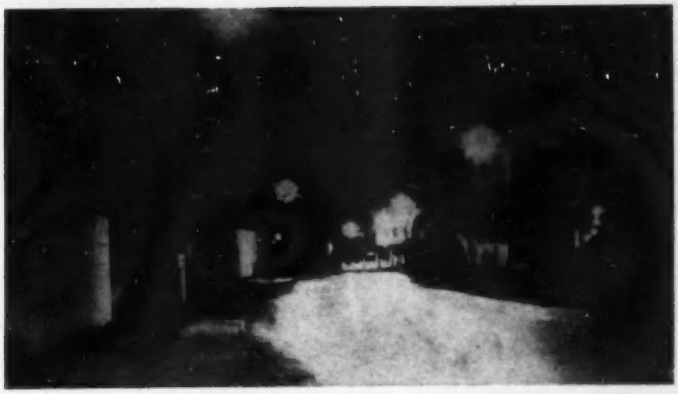

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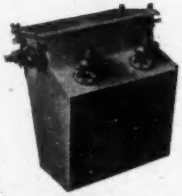

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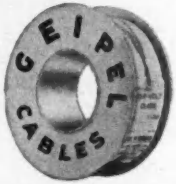

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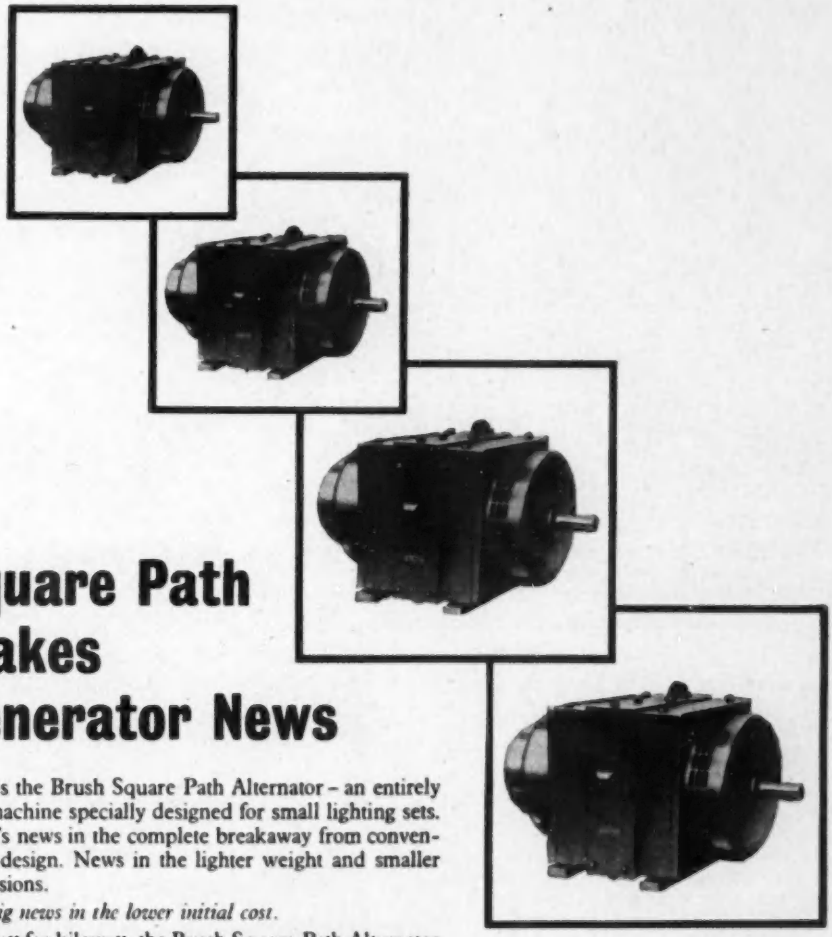

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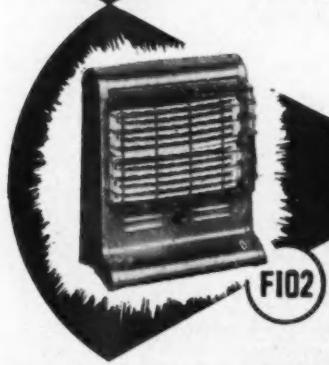

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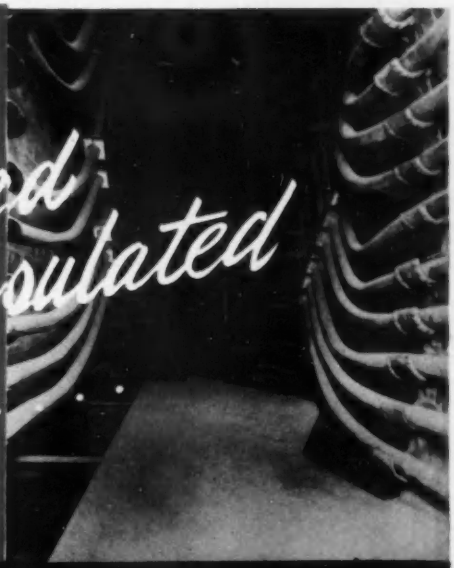

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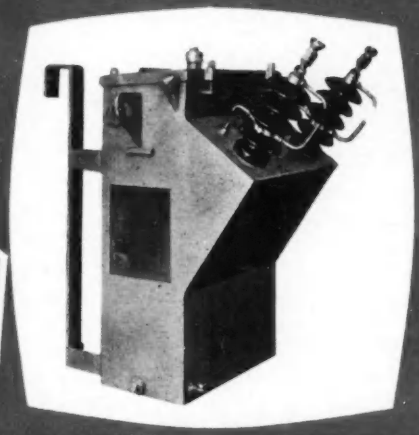

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